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OPPORTUNITIES FOR INCREASING HARVEST AND UTILIZATION OF MIXED CONIFERS IN ARIZONA AND NEW MEXICO

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FINAL REPORT

OPPORTUNITIES FOR INCREASING HARVEST AND UTILIZATION OF MIXED CONIFERS IN ARIZONA AND NEW MEXICO

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Preface

This report was prepared using both published information and the results of discussions with personnel of the U.S. Forest Service, Bureau of Indian Affairs, state forestry agencies, and the wood industry. The cooperation of these individuals was exceptional and the report is a much more complete document given their input.

The report is sectioned with each processing center as a case study. Since each is discussed separately there is some repetition concerning certain points. The first discussion of a processing center (Fredonia, AZ) is more in depth in terms of general analysis procedures. This detail is not repeated for other processing centers.

The on-site discussions with individuals were conducted, for the most part, by Mr. W. Keith Kelso. The statistical analysis of data was completed by Mr. Steve Sherwood and Mr. Edward Odenwalder. These individuals did an outstanding job and their care for detail has resulted in a more complete report. Finally, the careful typing of the work by Gerry Schmidt and Carole Travis is gratefully acknowledged.

I. Introduction

a. Problem

The mixed conifer type in Arizona and New Mexico has many uses besides timber, in particular multiple use values associated with wildlife, water yields, and recreation. Potential production possibilities for these uses have been hampered, in part, due to the inability of the timber value to cover the costs of applying management practices. There are several factors which have contributed to this situation. In many cases, the mixed conifer stands are made up of small-sized timber. This not only makes the logging more expensive but also requires mill production capability for handling small-sized materials. Further, the mixed conifers include tree species which do not typically produce high quality lumber, the major wood product currently produced in the region.

The characteristics of the timber itself are not the only problems associated with the resource's management. Many of these stands are not readily accessible. Sometimes the stands are located on slopes that are steep and on soils that are subject to erosion. Because of these conditions, some mixed conifer stands are classed as being in the Marginal or Special timber component in many Southwestern National Forests. Together, these site factors sometimes result in higher logging and road building costs which tend to make the economics of applying multiple use prescriptions even more of a problem.

Application of silvicultural prescriptions to meet multiple use management objectives requires, in part, viable economic outlets for the timber removed. In essence, it is the timber value that covers the costs of applying many of the multiple use management techniques. In order to develop improved multiple use management of this type and make

reasonable judgements concerning what future management is possible, the problem must be analyzed in terms of the economics of timber supply and wood product possibilities. To increase harvest to allow for workable management schemes, wood product opportunities need to be identified which are both technically and economically viable.

b. Background

1. The Mixed Conifer Resource

The mixed conifers are typically found at higher elevations above the ponderosa pine and below the spruce-fir types. From elevations of 7,000 to 8,500 feet, the stands are made up of varying combinations of Douglas-fir, white fir, aspen and limber pine. From elevations of 8,500-10,000 feet, the stands include Engelmann spruce, blue spruce, subalpine fir, aspen and corkbark fir. Depending on particular topographic conditions, such as aspect, the stand species make-up can be quite different even at the same elevation. For the most part, Douglas-fir makes up the largest portion of stands classified as mixed conifer in Arizona and New Mexico.

To be classed as a mixed conifer stand, the stand must not have one species which makes up more than 50 percent of the stand. Thus, the mixed conifer type by definition will typically contain a wide range in relative volumes and type of timber. This definition is used by the National Forest System in their timber management planning and inventory. On the other hand, the forest inventory unit (Intermountain Station) does not define a mixed conifer type in the same way. In fact, mixed conifers are not recognized as a type at all. Instead inventories are made on a species-by-species basis. Thus all state and private land timber inventories in the two states do not have a mixed conifer category.

In the Southwest the mixed conifers generally occur on more productive sites, compared to ponderosa pine. Because the stands are located at higher elevations, they tend to receive more moisture which is a critical tree growth factor in that area. In terms of watershed management to increase water yields, the mixed conifers are the first forest type in the forest elevational range where management prescriptions can influence water yields. At the same time, many of these stands are located on steeper slopes, often having unstable soils and therefore requiring particular care in applying prescriptions to increase water yields.

Most of the mixed conifer stands are many aged stands of sawtimber size. Many of the stands have fairly large sawtimber (compared to ponderosa pine) with significant volumes per acre. The species which make up the smaller-sized material are normally either aspen or spruce. In general, most of this larger-sized material is located on National Forest lands. The smaller-sized sawtimber is located primarily on state and private lands.

Major causes of mortality and growth loss include dwarf mistletoe, spruce budworm, wind, fire and lightning strikes. Mortality in some stands is quite high, to a point where certain stands in the standard and special component have a net growth of less than 20 cf/A/year.

There are mixed conifer stands scattered within the mountains of both states but most all are located in just a few mountain ranges. In Arizona the mixed conifers are located primarily in the northern part of the state in the White, Christo and San Francisco mountains. In New Mexico the mixed conifer stands are located in the northern portion the state and in the Sacramento mountains in the southeast. The primary National Forests involved would be the Carson, Santa Fe, Kaibab, Coconino, Apache and Lincoln. The major Indian reservations which have mixed conifer

include the Mescalero and White River Apache. The only area where state and private ownership of mixed conifer is significant is the northern portion of New Mexico.

The following statistics (Table I-1) reveal certain salient elements concerning mixed conifers as well as the timber resource in general. First, the mixed conifer type (here defined as Douglas-fir and true fir) is much more prevalent in New Mexico than in Arizona. Second, the private ownership of timber is important in New Mexico whereas in Arizona it is fairly insignificant. In fact, New Mexico is one of the few western states which have a fairly large private ownership of timber. Third, both states have a large amount of noncommerical forest land classed in the pinyon juniper type. Fourth, both states have a large amount of sawtimber-sized timber. This proportion of sawtimber is among the highest in the western states. The sawtimber volumes in the mixed conifer, in particular, are quite large. Finally, the proportion of the cut which is made up of ponderosa pine is much higher in Arizona than in New Mexico.

2. Mixed Conifer Silvicultural Prescriptions

Silvicultural prescriptions for mixed conifers have primarily involved either shelterwood, selection or group selection type systems. Most of the stands are made up of species which have a certain amount of shade tolerance. This makes such prescriptions appropriate except where the stands are heavily infested with dwarf mistletoe. Given this infestation, the entire overstory should be removed. Further, since some conifer stands are located in zoned areas or on steeper, unstable terrain, these type prescriptions are necessary to help prevent soil disturbance and minimize visual impact due to harvesting. In applying such prescriptions, slash is normally scattered to help provide shade

Table I-1. Summary Statistics for New Mexico and Arizona.

	New Mexico		Arizona	
	Totals	Percent of Total	Totals	Percent of Total
Forested area (incl. pinyon, juniper)	18.2 mill acres	-	20.6	-
Comm. Forest (not incl. pinyon, juniper)	6.3 mill acres	100.0	4.0	100.0
Public comm. forest	4.4 mill acres	69.8	3.8	95.0
Private comm. forest	1.9 mill acres	30.2	.2	5.0
Sawtimber comm. forest	5.5 mill acres	87.3	3.7	92.5
Timber cut (1962)	40 mill c.f.	-	65.9 mill c.f.	-
Roundwood for lumber	31 mill c.f.	-	50.0 mill c.f.	-

	New Mexico				Arizona			
	Growing stock mmcf	% of Total	Sawtimber mmbf	% of Total	Growing stock mmcf	% of Total	Sawtimber mmbf	% of Total
Ponderosa pine	3,366.5	58.4	13,925.4	57.2	3,842.4	80.7	17,508.9	79.4
Douglas-fir	1,004.3	17.4	4,809.6	19.8	336.8	7.0	1,596.7	7.2
True firs	667.2	11.6	2,368.9	19.7	226.8	4.8	1,118.4	5.1
Spruce	558.3	9.7	2,599.3	10.7	294.4	6.2	1,545.3	7.0
Other soft woods	169.7	2.9	624.4	2.6	62.2	1.3	293.7	1.3
Total soft woods	5,766.0	100.0	24,327.6	100.0	4,762.6	100.0	22,063.0	100.0
Aspen	599.2	-	1,573.4	-	219.6	-	647.7	-
Total softwood other than ponderosa pine	2,399.5	41.6	10,402.2	42.8	920.2	19.3	4,554.1	20.6

for the reproduction and decrease soil erosion. Most often regeneration has not been a problem in the mixed conifer type; however, in certain areas where a suitable understory did not exist, there has been some difficulty in establishing a new stand. In these areas, shelterwood systems should be prescribed.

Timber stand improvement and thinning prescriptions could be useful in helping increase the growth and quality of mixed conifer stands. However, improvement cuts/thins have been difficult to implement due to the high costs of these operations relative to the value of the timber removed. If such programs could be implemented, it has been estimated that the growth in stands could average 43 cf/A/year. Presently growth in mixed conifer stands is rather low due to mortality. Decreasing this mortality is a key management concern.

In many areas applying these prescriptions will require the use of some type of cable logging system. Currently, cable logging is now being carried out on the Lincoln and Santa Fe National Forests.

3. Wood Product Industry and Current Wood Utilization

The Southwest was one of the last areas within the United States to be accessed and developed. The first timber harvest of any significance began in the late 1870's and was used to produce railroad ties and bridging. As the industry and states' economies grew, they first produced lumber primarily for the local mining and oil industries in the area. Then, as well as now, the primary timber species cut was ponderosa pine and most of the timber harvests were on lands controlled by either the U.S. Forest Service or Bureau of Indian Affairs.

The wood products industry continued to grow and peaked in the 1950's when almost one of every seven people within the states was

employed by the lumber industry. Since the early 1960's, there has been a general decline in numbers of firms, employment and lumber production. Statistics compiled by the Western Wood Products Association indicate that in 1979 a total of 7,400 people were employed in the lumber and wood products industry (except furniture) in Arizona. This represents a slight increase over the 1978 figure of 7,200 jobs. In New Mexico a total of 3,100 jobs were generated in the lumber and wood products industry in 1979. This figure is down from 3,200 in 1978. Correspondingly, there has been a decline in the timber volumes harvested. Over the past nine years, lumber production in both Arizona and New Mexico has remained fairly constant with slight declines occurring over the past two or three years. From 1971 to 1979 lumber production in Arizona averaged 34 mmbf per year with a high of 392 mmbf in 1977 and a low of 306 mmbf in 1974 (Table I-2). This corresponds to an average yearly production of 246.1 mmbf in New Mexico with a high of 295 mmbf in 1972 and a low value of 210 mmbf in 1975. Historically, ponderosa pine has been the primary species used for wood products. In the past that species accounted for over 90-95 percent of the harvest. This is shown in Table I-3. Over the years, most of these timberlands have been cut over and now these ponderosa pine forests typically have less volumes per acre than did the old growth ponderosa pine stands of the past.

Currently, ponderosa pine still ranks high in terms of timber removals. Even now it accounts for at least half of the harvest on most National Forests. However, the mixed conifer type is becoming an increasingly large portion of the harvest. There is some speculation that

Table I-2. Lumber Production in Arizona and New Mexico (in thousand board feet).

Year	Arizona	New Mexico
1971	331,000	285,000
1972	342,000	295,000
1973	314,000	240,000
1974	306,000	222,000
1975	316,000	210,000
1976	380,000	242,000
1977	392,000	250,000
1978	350,000	244,000
1979	337,000	227,000

Source: 1979 Statistical Yearbook of the Western Lumber Industry. WWPA. August 1980.

Table I-3. 1978 Profile of Arizona and New Mexico Sawmills.

	Arizona	New Mexico
Species Cut		
Ponderosa pine	87.3%	65.6%
Douglas-fir and Larch	9.6%	14.8%
White fir	2.1%	11.9%
Engelmann spruce	1.0%	6.7%
Other	-	1.0%

if any significant increase in harvest is to occur it must involve more use of the mixed conifer type.

At present, there are five large firms which account for most of the wood product production in the two states. Duke City, Southwest Forest Industries, Kaibab, White Sands, and Bates companies produce most of the wood products. Smaller sawmills, although they exist, do not contribute a significant amount to the states' production. Since the early 1960's, their numbers and output have steadily declined.

Most of the current lumber production is in the form of kiln- or air-dried boards and dimension with some box, crate and dunnage material also being produced (Table I-4). Most of the lumber produced by the larger mills is graded material. It is normally distributed by retailers or wholesalers within the two states. The lumber is marketed within the states and to states adjacent to New Mexico and Arizona. New Mexico's sawmills market in Texas, Oklahoma and Arizona as well as the midwestern U.S. Arizona sawmills generally market in these same areas as well as in southern California.

There are a number of wood-fiber-using plants now operating, including both particleboard and pulp and paper mills. These mills use both roundwood and mill residues. Because of these plants, sawmill residues (planer shavings) have found fairly good markets in the two states. These materials are used as raw material input for production of wood fiber products, but in the Southwest, as in other areas, the residues also have found increasing appeal as a source of energy for the mill. Domestic fuelwood is also becoming increasingly used for home heating in recent years. In the Southwest the pinyon/juniper and alligator

Table I-4. Degree of Processing, 1978 Statistics.

	Arizona	New Mexico
Kiln-dried	71.0%	43.0%
Air-dried	12.7%	38.1%
Green	16.3%	18.9%
Rough	15.4%	9.5%
Surfaced	84.6%	90.5%

Source: 1979 Statistical Yearbook of the Western Lumber Industry, WWPA. August 1980.

juniper have been the primary species used, but ponderosa pine is also utilized, particularly in homes around the larger population centers. Wood's use for energy is expected to increase in the future.

If there is to be an increase in harvest and use of mixed conifers for wood products, it would seem that there would need to be some shifting in product lines or new technology utilized. For example, Douglas-fir is normally not as suitable for boards as is ponderosa pine. Increased harvest of Douglas-fir would rely, in part, on pulpwood markets, stud, plywood, or laminated products. Further, white fir is most often only suitable for crate or box material and aspen is generally only suitable for pallet or paneling material or fiber products such as excelsior or pulp. The variety of species in mixed conifer stands will require some product diversification in order to fully utilize the raw material resource. It is not clear at this time what combination of industrial capacity would be necessary. But it is certain, given the characteristics of the resource, that some innovation in wood utilization will be necessary in order to properly use the raw material.

4. National Forest Planning

Currently all National Forests in Arizona and New Mexico are involved in developing land management plans in accordance with Section 6 of the National Forest Management Act of 1976. None have been completed to date. The target date for completion of the plans is 1983. It is not certain how these plans will change the harvest schedules for timber. There may or may not be a major impact on harvest levels.

This planning effort requires substantial amounts of resource and economic information. In particular, cost/price information for economic

efficiency analysis has been an important need. Costs of supplying timber under different harvest scenarios is a key factor in determining capabilities and suitabilities of lands for timber production. The programs scheduled for mixed conifers in the future will depend on the analysis accomplished as part of this planning process.

II. Study Objectives and Approach

The study objectives are:

To estimate, from the best available data, the volumes, values and costs of merchantable and nonmerchantable roundwood and forest and mill residues available at various processing locations in Arizona, New Mexico and southwestern Colorado from forests of the mixed conifer type;

To determine current industry utilization capacities and capabilities for each processing center and existing/potential market area, volume and value;

To gather and compile data and assess the technical feasibility of producing wood and energy products from various classes of mixed conifer raw material;

To determine and assess economically viable opportunities for resource management and wood utilization in the mixed conifer type.

The basic approach to this study will involve collecting and organizing the best available data concerning forest and mill residue volumes, values and procurement costs for mixed conifer raw material at selected processing points. Information concerning wood industry production capacities, existing/potential market areas, volumes produced and values will also be collected for each processing point selected. This information will be acquired primarily from the USDA Forest Service Region 3 office, local industry, state forestry organizations, local universities and individual National Forests in Arizona and New Mexico. There will be no

primary collection of this data. All information will be derived from secondary sources.

The raw material information will be consolidated on a timbershed/processing center basis in order to insure the supply and cost information has economic meaning given the present timber harvesting and wood product processing center configuration. The information concerning wood product volumes, values and capacities will also be presented separately for each timbershed/processing center. Market information will be aggregated where several processing centers would distribute products to the same destinations and incur similar marketing problems. This market information will also be derived from secondary sources.

Determining the technical feasibility of new wood products and energy will involve assessing available technological information and relating it to the mixed conifer composition in the Southwest. To the extent possible, some estimate of manufacturing costs and product values will also be made as part of this work. It is anticipated that this general suitability assessment can be made using the results of previous technical studies in the wood technology area and the results of the raw material assessment portion of this study.

The raw material, market and technical feasibility information will be analyzed together to determine possible opportunities for increasing harvest and wood utilization in the mixed conifer type. This analysis will include development of economic supply schedules for the timbersheds, a comparison of actual to potential harvest and current to potential mill capacity and a determination of profitable products and their best marketing locations.

III. Area of Concern and Processing Center Selection

The area of concern was defined using timber type maps available at the USDA Forest Service Region 3 office. The locations of substantial acreages of mixed conifer timber are recorded on these maps. This information was transferred to USGS maps of New Mexico and Arizona to allow additional information (e.g., processing centers, timbershed boundaries, standard/special/marginal timber component categories) to be recorded later along with the timber type location. Figures III-1 and III-2 show the area of concern. The area is made up of the Zuni and Jemez mountains of north central New Mexico, the Sacramento Mountains of southeastern New Mexico and the White Mountains and North Kaibab areas of Arizona. Other scattered blocks of mixed conifer exist but they are much smaller in size than at the locations mentioned above. The definition of this area of concern provides the basis for the next step, that is, defining what would be considered existing and potential processing centers.

Processing centers where chosen on the basis of their mill capacity and their proximity to the mixed conifers. As a general rule, mills having a capacity of 15 mmbf per year or greater and being within 100 miles of the mixed conifers were included, initially, as a processing center. The wood product directories prepared by the state forestry agencies were used to determine these mill capacities.

Using this criteria, four processing centers were originally selected for Arizona: Fredonia, Eagar, Whiteriver and Snowflake. However, after consulting with U.S. Forest Service and mill personnel, Whiteriver and Snowflake were deleted. The Whiteriver mill is a tribal mill which harvests timber only on the White River Apache Reservation. Further, since most of the mixed conifer nearest Snowflake is on the Reservation, the

Figure III-1. Mixed Conifer Location in Arizona.

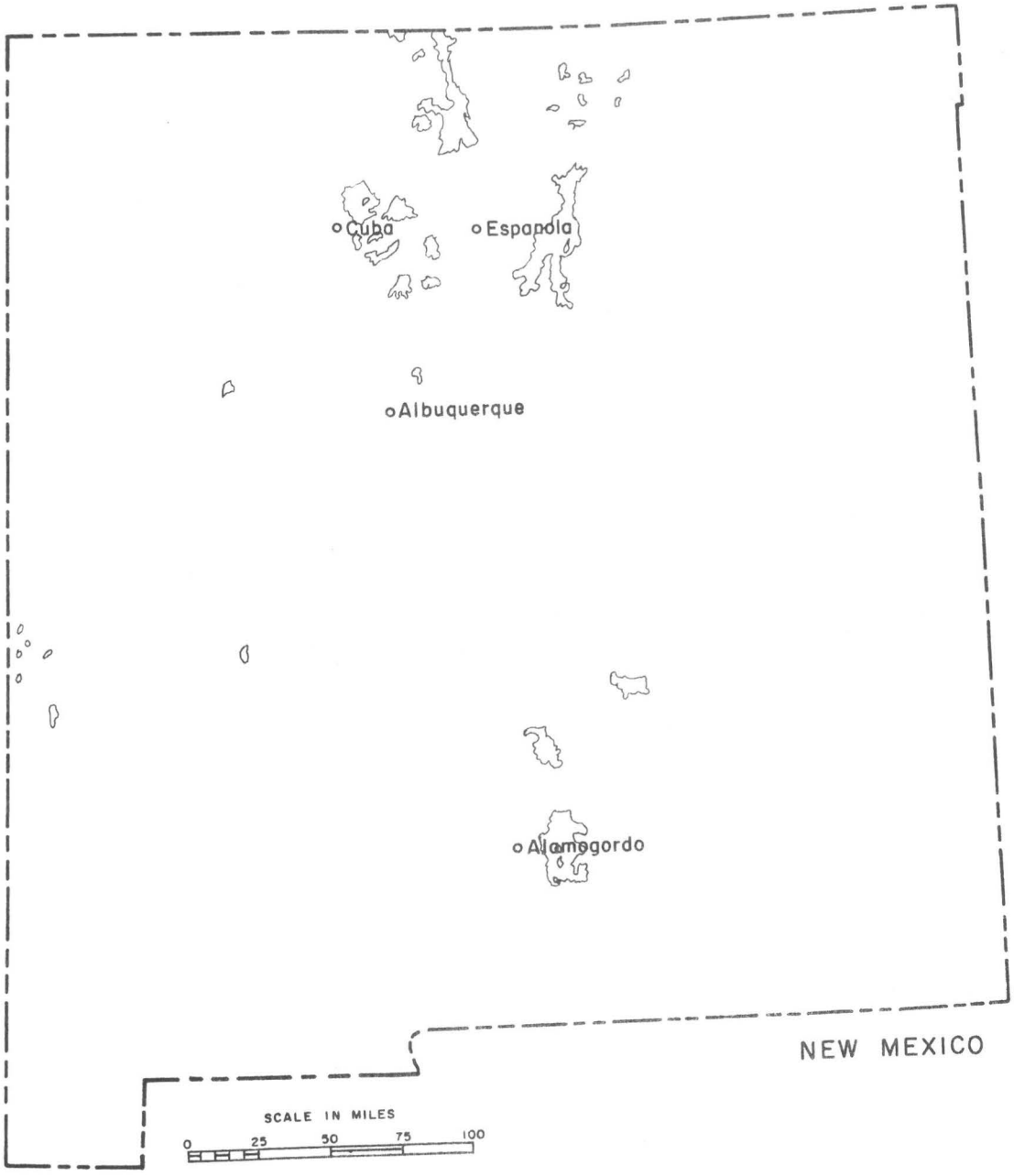


Figure III-2. Mixed Conifer Location in New Mexico.

mills there would not have access to it. Therefore, these two potential processing centers were dropped resulting in Fredonia and Eagar being considered as processing centers. Table III-1 indicates available information about the mills in these two locations.

Initially, five processing centers were selected for New Mexico: Albuquerque, Espanola, Cuba, Alamogordo and Las Vegas. They all met the criteria of a capacity of greater than 15 mm per year and were within 100 miles of substantial acreages of mixed conifer. However, after consulting U.S. Forest Service personnel, Las Vegas was deleted since the mill actually produces far less than 15 mm. There are several other small mills in the area that process only 50 to 100 m per year and many of these are currently idle. They are not included in the description of processing centers. Table III-1 shows the available information for the mills in the four locations.

There was consideration given to consolidating some mills into one processing center; Cuba-Espanola, for example. However, this would result in less accuracy related to both supply and cost figures so the four processing points were kept separate. This separation, however, will cause some overlap to occur between timbershed areas.

IV. Timbershed Boundaries

Each processing center will have a unique wood procurement area since topographic features and transportation systems will vary by site. Depending on the location of the processing center this supply territory may be composed entirely of mixed conifers or include other timber types. When this occurs, the rest of the processing center's supply territory is included even if it contains other timber types. That is, all timber types within the tributary boundary are considered as part of the timber

Table III-1. Description of major mills at the Processing Centers.

Processing Center	Mill Name	Mill Type	Mill Capacity	# of Emp	Degree of Processing	Operating Radius	Equipment	Species Processed	Products	Markets
Albuquerque, New Mexico	Bates Lumber Co.		20 MM/YR				Debarker, band saw, double cut saw, edger, chipper, planer, kiln, other	Ponderosa pine Douglas fir	Lumber, chips, bark mulch, fuelwood	
	Duke City Lumber Co.						Kiln, planer	Ponderosa pine Douglas fir White fir	Lumber	Secondary manufacturer, wholesalers, retailers
	Ponderosa Products Co.		42 MM SQ FT						Particle-board	
Alamogordo, New Mexico	White Sands Forest Products		20 MM/YR				Debarker, band saw, skragg saw, gang saw, edger, chipper, planer, other	Ponderosa pine Douglas fir White fir	Lumber, studs, chips	
Cuba, New Mexico	Duke City Lumber Co.		25 MM/YR				Debarker, band saw, edger, chipper, planer	Ponderosa pine Douglas fir White fir	Lumber, chips	
Espanola, New Mexico	Duke City Lumber Co.		25 MM/YR				Debarker, band saw, double cut saw, edger, chipper, planer, other	Ponderosa pine Douglas fir White fir	Lumber, chips	
Eager, Arizona	Southwest Forest Industries	Stationary full time	15.1-35 MM/YR	83	Kiln dried, air dried green surfaced	Greater than 100 miles	Band headsaw, sash gang saw rosser, debarker edger, residue chipper, planer dry kiln	Ponderosa pine Douglas fir White fir	Dimension, timbers, shop, molding	Secondary manufacturer, wholesalers
Fredonia, Arizona	Kaibab Ind.	Stationary full time	35.1-50 MM/YR	250	Kiln dried	50-100 miles	Band head saw, sash gang saw ring debarker, edger, headrig, chipper, residue chipper, planer, dry kiln	Ponderosa pine Douglas fir White fir Engelmann spruce	Dimension, timbers	Secondary manufacturer, wholesalers

Gallegos, Raymond R., 1979 Wood Industries of New Mexico. New Mexico Division of Forestry, Santa Fe, NM, 25 p.

Koch, Charles, 1978, Primary Wood Industries of Arizona, 1978. Arizona Landmarks, Vol. 8, No. 5, 1978, Arizona State Land Department, 11 p.

supply. Boundaries for processing center tributary areas may overlap; however, each center is analyzed as a separate case study. The areas where overlap occurs are documented.

The boundaries were established based on personal consultations with National Forests, the Bureau of Indian Affairs and the local industry. The criteria used to establish boundaries included past procurement activities and what was likely to be available in the "foreseeable future." While the boundaries must be economically sound, every effort was made to utilize existing inventory data and classification, thus avoiding unnecessary extrapolation or adjustment error. Thus, additional criteria used to designate boundaries included considering what was already developed as sustained yield units and/or what was likely to be planning units within the new Forest plans.

The following figures, IV-1 and IV-2, indicate the timbershed boundaries for each of the processing centers selected. The reasoning behind the selection of specific boundaries will be included in the next section which details the timber and mill characteristics of each processing center individually.

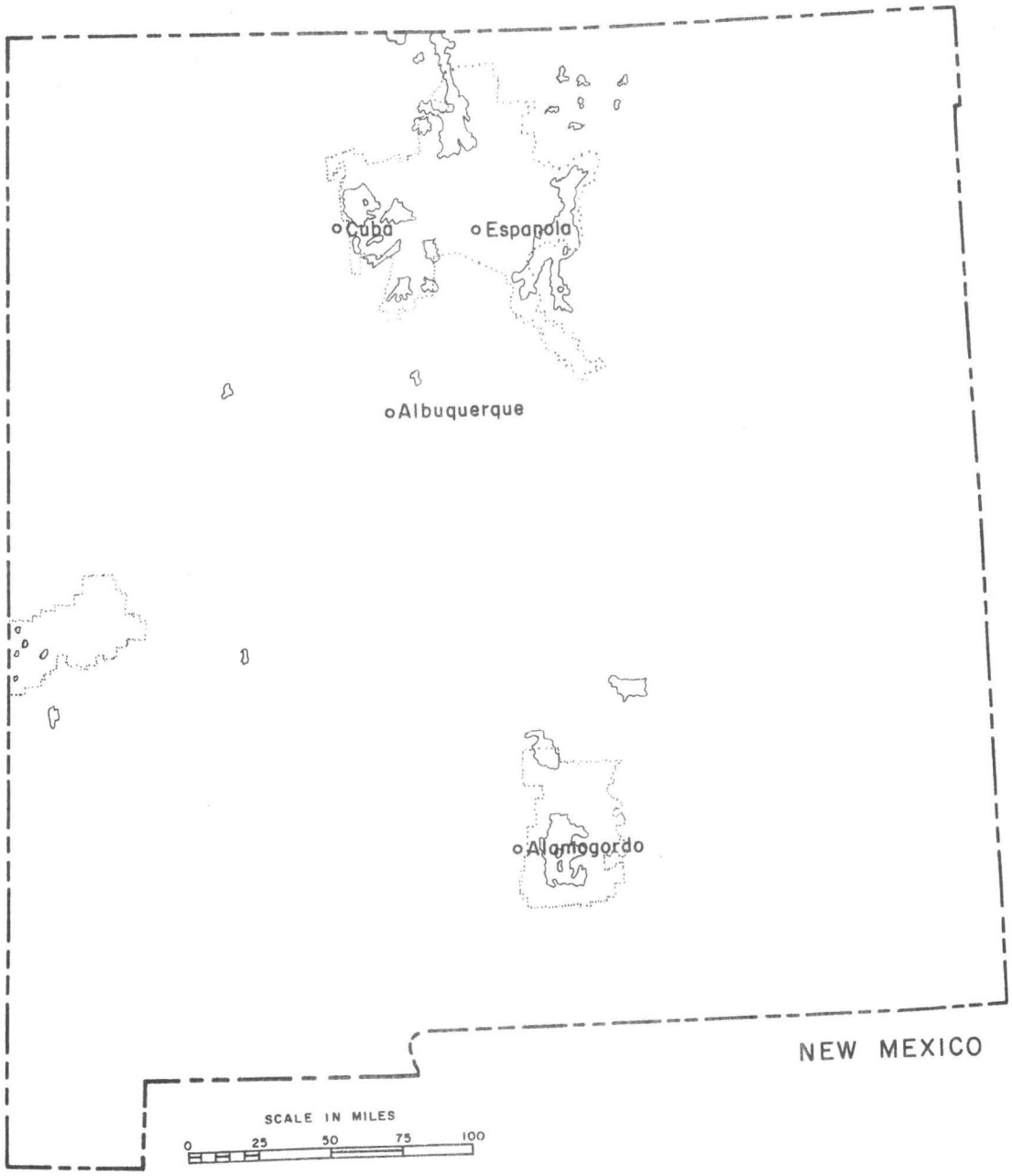
V. Timber and Mill Characteristics for Each Processing Center

This section contains the data and analysis concerning the timber resource, costs, and mill characteristics within each timbershed. The resource information presented includes species, volumes and acreages as well as harvest schedules. The sources of the data are listed under the table where this information is presented. For the most part the data was derived from U.S. Forest Service timber management plans, Intermountain Station publications, and personal communications.

As pointed out earlier the timbershed boundaries were selected so as to avoid unnecessary extrapolation of the data. Where this is done, figures

..... Timbershed boundary

Figure IV-1. Timbershed Boundaries for Selected Processing Centers in Arizona.



..... Timbershed boundary

Figure IV-2. Timbershed Boundaries for Processing Centers in New Mexico.

regarding inventory and harvest did not need to be adjusted. However, in certain cases this was unavoidable and the figures needed to be adjusted for the tributary area concerned. In general, this adjustment process involved prorating the figure (volume, acreage or harvest) based on the proportion of the forest included in the timbershed. For example, if the potential yield was for the entire Forest and the timbershed represented only half the Forest, the potential yield was adjusted to one-half. This involved making a set of assumptions regarding the uniform distribution of the timber of the Forest. If a better process for adjustment was available, e.g., through the personal consultations with the on-site personnel, it was utilized.

The discussions of each processing center also include a cost analysis of timber supply in the timbershed. The data for this analysis was derived from U.S. Forest Service appraisal summaries for sales (that sold) over the last five years in the timbershed. The Statistical Program for Social Sciences (SPSS) was used to analyze the data. Descriptive statistics were developed for each cost category (e.g., logging). These were developed for all species and for ponderosa pine and mixed conifer separately. A statistical test was made to compare mean cost values for mixed conifer and ponderosa pine. Finally, timber supply schedules were derived for each timbershed. These schedules were based on the particular timber volume and cost information collected for that timbershed. Three schedules were constructed in each case, one for mixed conifers, one for ponderosa pine, and one combining the two.

The mill and market characteristics of each processing center are also discussed in this section. Most of the information presented in this discussion was obtained by informal consultations with mill operators.

Generally, the information concerns mill configuration, types and amounts of products produced, major market areas, and problems concerning timber supply and markets.

The processing centers are discussed in this order: Fredonia, AZ; Eagar, AZ; Alamogordo, NM; Espanola, NM; Albuquerque, NM; and Cuba, NM. The first discussion, Fredonia, AZ, presents details relating to certain procedures used in the analysis. These are not repeated in discussions of processing centers afterwards.

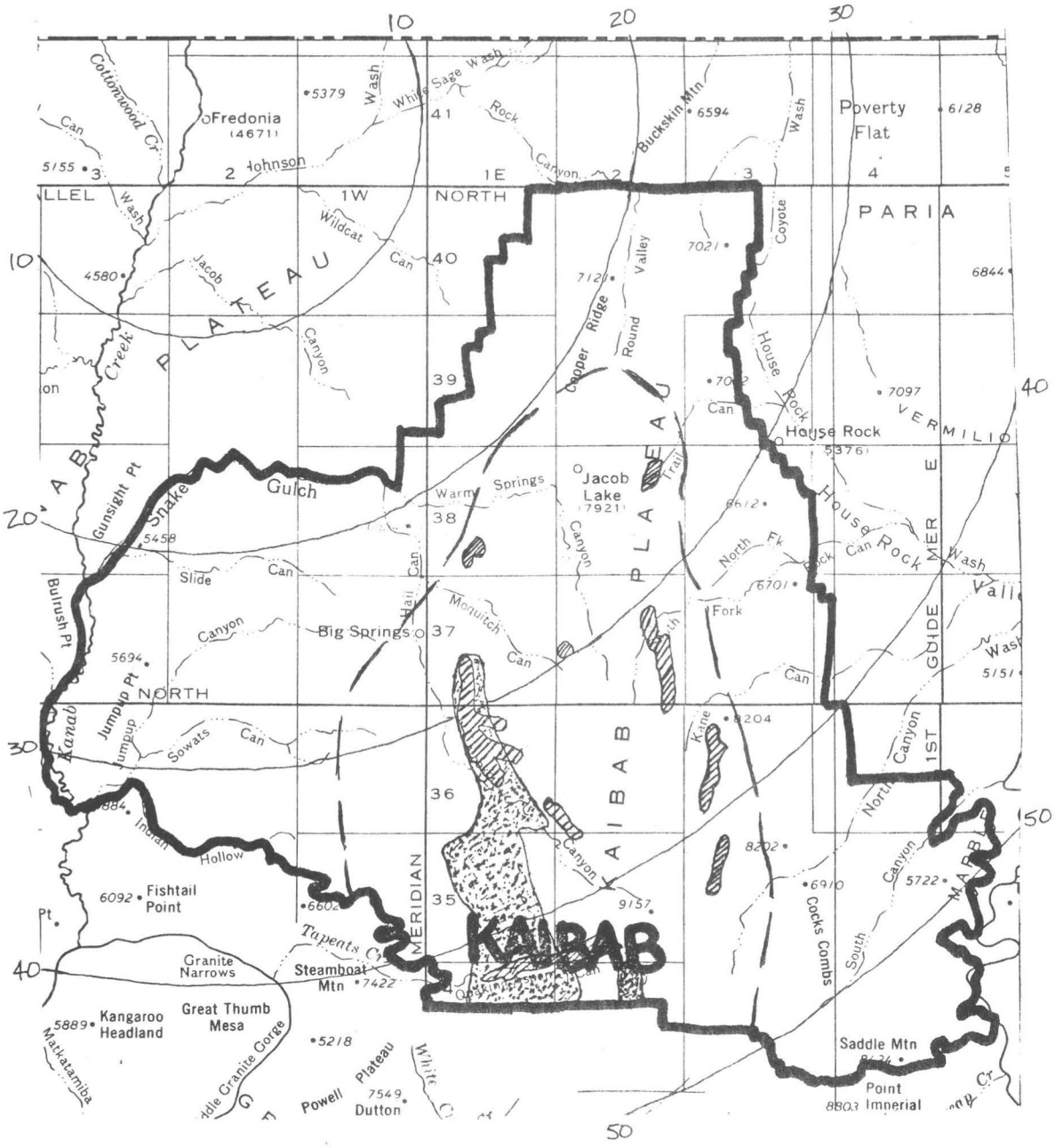
In the case of the three processing centers in northern New Mexico, the timber resource information is consolidated into one discussion for the three centers. There is considerable overlap between timbersheds and to avoid duplication between sections this was considered acceptable.

a. Fredonia, Arizona

1. Timber Characteristics

The Fredonia timbershed is composed of areas within the central portions of the North Kaibab National Forest. Figure V-1 shows the location and various characteristics of the timbershed. The majority of the areas outside of the North Kaibab boundaries are either nonforested or unproductive (< 20 cm ft/A/yr) forest land. In addition to the National Forest lands, there are 100 acres of privately owned commercial forest land within the timbershed. There was no adjustment factor required to prorate volumes or acreages in this timbershed. The forest boundaries exactly match those of the timbershed.

The timbershed includes 298,200 acres of commercial forest land (Table V-1). The standard and special timber components make up an overwhelming portion of this acreage, 291,000 acres. For the most part, the timbershed is made up of fairly flat terrain. The marginal timber component,



Map Key

Forest Boundary

Timbershed Boundary

Mixed Conifer

Spruce-fir

Marginal Land

Figure V-1. Timbershed Map, Fredonia, Arizona Processing Center.

Table V-1. Land Use Classification, Fredonia Timbershed.

	M Acres
Gross NF area	737.5
Non-forest	110.2
Forest	627.3
Production forest	298.2
Commercial	298.2
Standard	273.0
Special	18.0
Travel and water infl. zones	5.9
Backdrop and park impact	10.0
Recreation sites	2.1
Marginal	7.2
Inoperable	7.2
Unproductive	329.1

(p. 4, 1972 - TMP - North Kaibab Block, Kaibab NF)

7,200 acres, is scattered in small blocks throughout the commercial forest areas. Most of these marginal lands are occupied by mixed conifer stands. Many of these stands consist of fairly large sawtimber, 24" dbh and above. Within this timbershed the marginal lands are those that cannot be physically or economically logged with tractor-type equipment. Special component lands are those along roadways, near recreation sites, and in the "back-drop" areas near the Grand Canyon National Park.

The commercial forest land in the timbershed contains three major forest types, ponderosa pine (67%), mixed conifer (28%) and aspen (5%) (Table V-2). Tables V-3 and V-4 contain a summary of the acreage and volume figures for the timbershed as well as figures for potential and allowable annual harvest. Area and volume figures were derived from field inventory data obtained from 132 permanent sample plots. It is interesting to note that even within the mixed conifer designations 30% of the species' composition is ponderosa pine (Table V-5). Table V-6 indicates that the majority of the forest area is either in the Site I or Site II timber class. Mixed conifer, in particular, is located primarily on the better sites.

Most mixed conifer stands contain a combination of ponderosa pine, Douglas-fir and white fir with some Engelmann spruce, blue spruce and subalpine fir. Many of these stands are multi-storied stands and contain a mixture of mature sawtimber, small sawtimber (9-20" dbh) and poles/saplings. Regeneration typically occurs in clumps which results in groups of all ages and size classes within a stand.

The two largest problems influencing silvicultural practices in the mixed conifer types are the spruce budworm and windthrow. In particular, there is a spruce budworm infestation near the boundary of the Grand Canyon National Park that seems to be currently spreading northward.

Table V-2. Area by Major Forest Types (Operable Acres).

Ponderosa pine	198,002
Mixed conifer	82,766
Aspen	14,007
Total	294,775

(From p. 14, Graph (1) 1972 - TMP Block Kaibab Block, Kaibab NF)

Table V-3. Summary Statistics for Fredonia Timbershed.[1/]

Ownership	Acres	Volume
Public	723,800	-
Private	355	-
Land Use Classification, Regulated Commercial Forest		
Standard Component	273,000	-
Special Component	18,000	-
Marginal Component	7,200	-
Noncommercial Forest Land	329,100	-
Net Timber Volumes[1/]		
Sawtimber[2/]		
Ponderosa Pine	-	438,265
Mixed Conifer	-	237,332
Other[3/]	-	2,116
Total Sawtimber Volume	-	677,713 MCF
Poletimber		
Ponderosa Pine	-	13,627
Mixed Conifer	-	23,021
Other[3/]	-	197
Aspen	-	71,673
Total Poletimber Volume	-	108,518 MCF
Seedlings and Saplings	-	N/A
Total Net Timber Volume, All Species and Sizes		786,231 MCF
Total Potential Yield[1/] (by component and type of harvest)		
Standard Component[4/]	129,200	
Shelterwood	15,400	
Sawtimber	-	50.25 MMBF
Products	-	91.5 M cunits
Intermediate	107,900	
Sawtimber	-	14.85 MMBF
Products	-	27.0 M cunits

Table V-3. Summary Statistics for Fredonia Timbershed (continued)

Total Potential Yield (continued)	Acres	Volume
Standard Component	129,200	
Patch Clearcut	5,900	
Sawtimber		59.0 MMBF
Products		10.7 M cunits
Special Component - Total	8,000	
Sawtimber		8.0 MMBF
Products		1.4 M cunits
Marginal Component - Total		
Sawtimber		9.3 MMBF
Products		0.3 M cunits
Annual Allowable Harvest		
Standard Component[5/]		50.25 MMBF
Special Component[5/]		0.8 MMBF
Products		
Softwoods[6/]		12,300 cords
Aspen[6/]		19,900 cords
Annual Mortality		4,998 MBF

[1/] Timber volume and potential yields are for the North Kaibab block, Kaibab National Forest.

[2/] 9.0" + DBH.

[3/] Softwood component within aspen type.

[4/] Acres included only those with programmed harvest.

[5/] Includes softwood sawtimber only (9.0" + DBH).

[6/] Products include softwood volumes between 5.0" - 8.9" DBH, and all aspen volume over 5.0" DBH.

Table V-4. Net Softwood Volumes (MCF) by Land Forest Type.

Forest Type	Acres[2/]	Sawtimber[1/] to 4.0" top d.i.b.	Poletimber 5.0"-8.9" DBH to 4.0" top d.i.b.	Total 5.0" + DBH to 4.0" top d.i.b.
Operable[4/]				
Ponderosa pine	198,002	436,703	13,533	450,235
Mixed conifer	82,766	219,019	21,720	240,739
Other[3/]	14,007	2,116	197	2,313
Subtotal	294,775	657,838 MCF	35,450 MCF	693,287 MCF
Inoperable[5/]				
Ponderosa pine	1,919	1,565	94	1,659
Mixed conifer	5,335	18,310	1,301	19,611
Subtotal	7,254	19,875 MCF	1,395 MCF	21,270 MCF
Summary commercial				
Ponderosa pine	199,951	438,268	13,626	451,894
Mixed conifer	88,101	237,329	23,021	260,350
Other[3/]	14,007	2,116	197	2,313
Total commercial softwoods	302,059	677,713 MCF	36,844 MCF	714,557 MCF

[1/] 9.0" DBH and over.

[2/] Does not include 7,015 acres of aspen type, but includes softwood component where it occurs.

[3/] Includes softwood volumes within aspen types (Appendix III, TMP - 1972, North Kaibab Block, Kaibab NF).

[4/] Areas that contain sufficient timber volumes to make commercial sales feasible.

[5/] Areas that contain insufficient commercial timber volumes.

Table V-5. Volumes of Species by Forest Type (Operable Volume) Scribner MBF.

Type	Pine	Percent of Total	Fir & Spruce	Percent of Total	Aspen	Percent of Total	Total
PP	2,111,125	92%	113,639	5%	58,722	3%	2,283,486
MC	336,766	30%	703,797	62%	101,764	8%	1,142,327
A	8,068	20%	1,409	3%	30,838	77%	40,315
Total	2,455,959		818,845		191,324		3,466,128

(p. 16, Table 2, 1972 - TMP North Kaibab Block, Kaibab NF).

Table V-6. Percentage of Site Class by Forest Type.

Forest Type	Class		
	I	II	III
PP	37	82	53
MC	61	15	27
A	2	3	20

(p. 15, Table 1, TMP - 1972)

2. Silvicultural Prescriptions

Silvicultural prescriptions for the areas designated as standard component lands involve group shelterwood cuts in ponderosa pine, patch clearcuts (< 20 acres) in mixed conifers, small patch cuts in aspen, and intermediate cuts as needed for certain species. Individual tree selection or small patch clearcuts are to be used in the special timber component (p. 20-22, TMP-1972). Machine piling and lopping and scattering of slash are normally required. Slash disposal is accomplished by the USFS in the majority of cases.

The prescriptions applied in the timbershed are greatly influenced by the need to consider the windfirmness of the trees. Also important is the fact that the area is a federal game preserve (Table V-7). Most prescriptions involve partial cutting of stands with removal of approximately 20% of the overstory basal area. These cuts are applied in such a way so as to minimize potential windthrow problems and increase windfirmness. For example, old or dying trees and suppressed or intermediate trees are removed and the cuts feathered so as not to create straight lines or square corners along the leeward boundary. The level of cutting is also varied depending on whether the stands have a large proportion of mature, windfirm trees or immature sawtimber which is more susceptible to windthrow. Reentry into partial cut stands is planned to occur every 15 years.

Prescriptions in the mixed conifers are designed to favor ponderosa pine and spruce regeneration rather than white or subalpine fir. The silvicultural reason for this preference is to enhance insect and disease control. The spruce budworm larvae seem to prefer the subalpine and white fir. Decreasing the proportion of these species may eventually reduce the possibility of future epidemics. To increase the amount of pine in

Table V-7. Coordinated Allowable Annual Harvest by Component, Type of Harvest, and Species.

Standard Component - Sawtimber	Volume
Regeneration cutting	
Ponderosa pine	14,850
Mixed conifer	5,900
Total	20,750 MBF
Intermediate cutting	
Ponderosa pine	21,800
Mixed conifer	7,700
Total	29,500 MBF
Total Standard Component	50,250 MBF
Special Component-Sawtimber	
Regeneration cutting	N/A
Intermediate cutting	800 MBF
Total Special Component	800 MBF
Total All Components	51,050 MBF
Products	
Softwoods[1/]	886 MCF/Yr.
Aspen[1/]	1,791 MBF/Yr.

Source: Timber Management Plan, North Kaibab Block, Kaibab National Forest. Approved 6/29/72

[1/] Products include softwood volumes between 5.0" - 8.9" DBH and all aspen volume over 5.0" DBH.

future stands, a larger portion of pine (seed source) would have to be retained now on the site rather than be harvested. Another possibility would be to increase plantings of pine seedlings.

Although many areas in the timbershed are overstocked (Table V-8), thinnings have not been applied because of the lack of markets for small-sized material. Further timber stand improvement operations, via thinnings, have not been applied because of mistletoe infestations. When infested stands are opened up through thinnings, the mistletoe is stimulated and spreads much faster through the regeneration. When mistletoe is present in large amounts, the entire overstory should be removed in order to prevent the infection from spreading to the understory. Thus, thinnings have not been applied in these cases. Instead, within this area timber stand improvement may best be accomplished through a superior tree program designed to develop superior seed sources. The timbershed is said to contain some of the best ponderosa pine in the Southwest. A superior tree program here would not only benefit this forest but also other forests in New Mexico and Arizona.

For the most part, regeneration has not been a problem on recent sales, at least when using group shelterwood techniques. Some slash is left to provide shade for seedlings. This slash treatment has been a key cost item in timber sales. Lopping and scattering and piling and burning of slash is a part of every sale. The mixed conifers typically have heavy concentrations of existing and sale-created slash. Roughly 5-20 tons of residue are left after logging mixed conifer sales.

3. Timber Procurement

The logging of both mixed conifer and ponderosa pine is done using conventional logging techniques. There are very few areas that would

Table V-8. Acres in Each Site Class, Over- and Understocked.

I	73,405	25	10,000	N/A
II	178,617	60	26,666	N/A
III	42,753	15	3,334	3/
Total				27,434

(p. 15, graph 2, p. 19, TMP - 1972)

1/ Precommercial thinning needed.

2/ Based on seedling count of less than 250 stems per acre.

3/ Site class III lands contain the majority of understocked areas. No breakdown on number of acres was obtainable.

require cable systems in this timbershed. The terrain is fairly flat (<20% slope) and there are no major logging problems regarding stream crossings. Skidding distances in certain cases can be rather long where the cutting is being done in scattered stands. Most sales require either specified roads or road reconstruction. Logging is said to make up about 25% of the total production costs for lumber.

Timber cut on the timbershed is used primarily by Kaibab Forest Industries located in Fredonia, Arizona. Virtually all of the logs go to the Fredonia mill with some smaller logs sorted out at Fredonia and later sent to another Kaibab mill in Panguitch, Utah, 60 miles north of Fredonia. There is a certain degree of competition for the timber between the Fredonia mill and some other mills in Utah, but normally Kaibab is the sole bidder.

There has only been one deficit sale in the area over the last five years. All other sales have been appraised with a positive residual value. There are no small business sale set-asides on this Forest. Table V-9 shows a statistical analysis of data from ten sales, both mixed conifer and ponderosa pine, that have sold over the last five years.

The typical log haul to Fredonia is between 30 and 55 miles. The trucks are normally routed off the main highway and the majority of the haul is on U.S. Forest Service roads. Several of the roads are closed in the winter; the typical operating season is from May 30 to December 15.

Although these individual cost figures do not indicate any major statistical differences between ponderosa pine and mixed conifers, the mill personnel feel strongly that mixed conifer logging is more expensive. They contend that the logging costs (less haul) are roughly 25% higher in the mixed conifer type. They say that smaller piece size, higher defect, heavier slash concentrations, and wetter road conditions all contribute to this additional cost.

In the sales analyzed, the percentage of total costs and lumber selling value made up by stumpage price is less for mixed conifer sales than for ponderosa pine (20% vs. 30%, Table V-10). Thus, ponderosa pine stumpage makes up a larger percentage of costs and selling value than does mixed conifer. Based on this it could be assumed that ponderosa pine lumber products are more sensitive to stumpage prices than are mixed conifer lumber mixes. However, one must keep in mind how the stumpage sales are determined via the residual appraisal method. Selling values of lumber are a key item in this appraisal process.

Table V-9. Summary statistics for individual sales on the Fredonia Timbershed, All Sales Combined Regardless of Species.

Variable	Unit of Measure	Mean Value	Range	Standard Deviation
1. Acres	Acres	4,701.90	2,687-6,434	1,198.37
2. Sale volume	Scribner MBF	17,079.00	6,300-29,300	8,305.85
3. Average sale DBH	Inches	21.65	19.9-23.0	.98
4. Average sale defect	Percent	14.59	9.0-18.30	3.12
5. Average overrun	Percent	25.81	12.8-29.7	5.14
6. Hauling distance sale-to-mill	Miles	41.09	30.10-56.00	7.96
7. Selling value, lumber tally	$ per MBF	$259.58	$218.03-$292.52	27.11
8. Selling value, log scale	$ per MBF	$326.14	$259.79-$405.25	49.17
9. Stump-to-truck logging cost	Cost per MBF	$33.91	$28.10-$43.03	5.38
10. Environmental protection cost	Cost per MBF	$17.41	$6.31-$38.68	9.02
11. Temporary and specified road cost	Cost per MBF	$12.58	$ .06-$50.21	14.30
12. Slash piling cost	Cost per acre	$54.60	$ .01-$96.58	24.33
13. Road maintenance cost	Cost per MBF	$4.31	$ .17-$9.49	3.84
14. Hauling cost sale-to-mill	Cost per MBF	$19.83	$4.45-$24.97	6.01
15. General logging overhead cost	Cost per MBF	$12.62	$10.06-$15.35	1.56
16. Manufacturing cost	Cost per MBF	$136.13	$114.62-$157.41	12.86
17. Slash lopping and scattering cost	Cost per acre	$16.79	$0.00-$67.95	19.03
18. Total production costs with road costs	Cost per MBF	$224.18	$181.23-$286.11	26.64
19. Total production costs without road costs	Cost per MBF	$211.59	$180.46-$273.01	25.90
20. Average advertised rate	$ per MBF	$89.09	$14.39-$184.82	53.39
21. Average advertised rate divided by total production cost	Percent	43.9%	5.3-98.6%	28.3

Table V-10. Fredonia Timbershed Summary of Individual Sale Statistics by Species Type.

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between Means[1/]
1. Acres	Acres				
Mixed conifer		4,456	2,687-6,120	1,440.08	Not tested
Ponderosa pine		4,947	3,647-6,434	1,003.22	
2. Sale volume	Scribner MBF				
Mixed conifer		17,054	6,300-29,300	10,540.90	Not tested
Ponderosa pine		17,104	9,000-27,100	6,641.44	
3. Average sale DBH	Inches				
Mixed conifer		21.52	19.9-22.7	1.18	No
Ponderosa pine		21.78	20.7-23.0	.85	
4. Average sale defect	Percent				
Mixed conifer		16.86%	15.5-18.3%	1.13	Yes
Ponderosa pine		11.75	9.0-14.0	2.22	
5. Average overrun	Percent				
Mixed conifer		23.98%	12.8-27.7%	6.54	Not tested
Ponderosa pine		28.10	27.5-29.4	.88	
6. Hauling distance, sale-to-mill	Miles				
Mixed conifer		46.6	38.0-56.0	6.61	Yes
Ponderosa pine		35.6	30.1-41.7	4.79	
7. Selling value, lumber tally	$ per MBF				
Mixed conifer		$265.84	$236.76-$283.95	19.41	Not tested
Ponderosa pine		253.33	218.03- 292.52	34.35	
8. Selling value, log scale	$ per MBF				
Mixed conifer		$319.80	$278.67-$345.14	28.69	No
Ponderosa pine		332.47	259.79- 405.25	67.20	
9. Stump-to-truck logging costs	Cost per MBF				
Mixed conifer		$35.45	$28.34-$43.03	6.03	No
Ponderosa pine		32.38	28.21- 38.49	4.77	
10. Environmental protection costs	Cost per MBF				
Mixed conifer		$18.65	$ 6.31-$38.68	12.31	No
Ponderosa pine		16.17	10.23- 22.20	5.26	
11. Temporary and specified road costs	Cost per MBF				
Mixed conifer		$ 6.85	$ .06-$14.49	6.74	No
Ponderosa pine		18.31	5.12- 50.21	18.25	
12. Slash piling cost	Cost per acre				
Mixed conifer		$53.55	$46.28-$61.37	6.62	Not tested
Ponderosa pine		55.64	.01- 95.58	35.85	
13. Road maintenance cost	Cost per MBF				
Mixed conifer		$ 4.19	$ .17-$9.49	4.48	Not tested
Ponderosa pine		4.44	.25- 7.87	3.62	
14. Hauling cost sale-to-mill	Cost per MBF				
Mixed conifer		$23.21	$19.14-$24.97	2.33	No
Ponderosa pine		16.45	4.45- 21.17	6.87	
15. General logging overhead cost	Cost per MBF				
Mixed conifer		$12.86	$10.84-$15.35	1.72	No
Ponderosa pine		12.38	10.06- 14.14	1.54	
16. Manufacturing cost	Cost per MBF				
Mixed conifer		$136.71	$120.58-$157.41	14.23	
Ponderosa pine		135.54	114.62- 149.57	13.00	
17. Lopping and scattering cost	Cost per acre				
Mixed conifer		$10.84	$0.00-$22.30	8.07	Not tested
Ponderosa pine		22.74	6.42- 67.95	25.71	
18. Total production cost with road costs	Cost per MBF				
Mixed conifer		$225.06	$181.23-$286.11	38.15	No
Ponderosa pine		223.29	206.10- 237.68	11.80	

Table V-10 (con't).

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between Means[1/]
19. Total production cost without road costs	$ per MBF				
Mixed conifer		$218.21	$180.46-$273.01	34.54	No
Ponderosa pine		204.98	187.47- 221.54	14.42	
20. Average advertised rate	$ per MBF				
Mixed conifer		67.84	$14.39-$120.32	44.17	No
Ponderosa pine		110.33	43.07- 184.82	57.73	
21. Average advertised rate divided by total production cost without road costs	Percent				
Mixed conifer		33.6%	5.3 - 66.7%	24.4	No
Ponderosa pine		54.3	22.2 - 98.6	30.5	
22. Average advertised rate divided by selling value, log scale	Percent				
Mixed conifer		20.6%	4.8 - 36.4%	12.7	No
Ponderosa pine		31.6	16.6 - 45.6	11.3	
23. Total production cost without road costs divided by selling value, log scale	Percent				
Mixed conifer		68.9%	54.7 - 90.4%	13.9	No
Ponderosa pine		63.9	46.3 - 81.3	14.3	

[1/] "Student" t-test (2 tailed) used to test for differences between mean values of each species, $\alpha = .05$.

Stumpage rates and their percentage of total cost and lumber selling value are higher for ponderosa pine because the selling value of lumber is higher for ponderosa pine. If one looks instead at the percentage of selling value that is made up of total costs (less stumpage) it is higher for mixed conifers (69% vs. 64%).

A statistical analysis was done to test for differences between mixed conifer sales and ponderosa pine sales. "Students" t-test ($\alpha = .05$) was used to test for major differences between mean values given mixed conifer and ponderosa pine sale variables. Those variables showing a statistically significant difference include haul distances and average defect (Table V-10). Mean values for other variables were not identified as being different from a statistical standpoint. It should be noted that this was a rather small sample size and that 3 of the 5 "mixed conifer" sales were comprised mainly of ponderosa pine, 91%, 83%, and 72%, respectively. These factors would obviously have an effect on the figures for the "mixed conifer" sales and the t-test results.

Since most of the sales were made up largely of ponderosa pine, the figures concerning logging and manufacturing costs are very similar. The fact that hauling distance was significant was probably a result of the five mixed conifer classed sales being in the general area of the mixed conifer type, even though the sale was largely marked for ponderosa pine. Under these conditions there was still a major difference in levels of defect. Sales with an even larger proportion of species other than ponderosa pine would tend to increase the significance of this difference. Increasing the harvest of mixed conifers will have a major impact on sale defect levels.

4. Actual Cut, Programmed Cut, and Potential Yield

Tables V-11 and V-12 show that there has been an increase in both the allowable cut and actual cut over the past 20 years. This probably is a result of improved access. The programmed harvest has been heavily weighted towards ponderosa pine. This is due, in part, to the fact that the ponderosa pine type acreage amounts to 67% of the forest total with mixed conifer and aspen amounting to 28 and 5%, respectively. Each of these types contains ponderosa pine species amounting to 92, 30, and 20%, respectively. Thus, the total pine volume make-up amounts to approximately 70% based on acreage estimates while the annual cut has averaged about 10% more, or 81%. There are currently no sales which are mostly made up of a species other than pine. Of the ten sales analyzed, only two had a percentage make-up of pine less than 80%. Based on the overall forest species composition, it would seem reasonable to expect about 70% of the timber cut annually to be ponderosa pine.

The actual cut is about 27% less than the current programmed cut, 40 mmbf compared to 51 mmbf (Table V-13). This seems to indicate an opportunity for increased cutting which is further backed by the fact that all sales that have been offered in the timbershed have sold. There is, however, currently a backlog in the cutting schedule for these sales.

Under a potential yield program of intensive management, there would be up to 80 mmbf available annually which would include considerably more intermediate harvests than are currently being conducted (Table V-14). This would provide additional possibilities for increased wood utilization and expanded mill capacity. The current mill capacity is 50 mmbf which indicates the possibility for approximately 60% increase

Table V-11. Trends in Allowable Cut.

Year	Allowable Annual Cut
1942	13.4 MMBF
1948	27.7 MMBF
1956	42.0 MMBF
Proposed-1972 plan	52.9 MMBF

(p. 20-22, TMP - 1972)

Table V-12. Actual volume cut by species.

Year	PP	DF	WF	SP	Total
61	17661	990	2300	150	21,101
62	24458	2785	2728	1964	31,935
63	27873	3928	5041	2095	38,937
64	36926	2612	2876	1410	43,824
65	43402	3661	4989	3207	55,259
66	27631	2878	2665	2009	35,183
67	33282	2959	2765	2588	41,594
68	24945	2087	3935	1450	32,417
69	34243	2273	1912	1802	40,230
70	29967	1932	2986	1551	36,436
71	29647	851	1581	838	32,917
72	29142	2492	3257	2231	37,122
73	28059	2968	3633	3191	37,851
74	32148	2219	3727	2569	40,663
75	27686	1969	4926	1661	36,242
76	39821	1551	5274	3062	49,708
77	42689	1640	4501	740	49,570
78	33540	1127	5064	1150	40,881
79	31683	1668	5074	1737	40,162
80	41060	1185	2022	608	44,875
	635263	43775	71256	36013	
	81%	6%	9%	4%	
Average cut/year by species	31763	2189	3563	1801	

Table V-13. Fredonia Processing Center, Comparison of Actual cut to Programmed cut, potential yield and mill capacity.

Potential Yield	76.00	MMBF/Yr.
Allowable Cut[1/]	66.43	MMBF/Yr.
Actual Cut[2/]	39.32	MMBF/Yr.
Mill Capacity[3/]	35.1-50	MMBF/Yr.

[1/] Sawtimber potential yield.

[2/] Average 1961-1980.

[3/] Log scale

Table V-14. Potential Yield.

Management Component	Acres (M)	Sawtimber		Products	
		M cunits	MBF	M cunits	M cords
Standard - total	129.2	898.3	502.5	91.5	120.6
Shelterwoood	15.4	265.5	148.5	27.0	35.6
Intermediate	107.9	527.4	295.0	53.8	70.8
Patch clearcut	5.9	105.4	59.0	10.7	14.2
Special - total	8.0	14.3	8.0	1.4	1.9
Marginal - total[1/]	7.2	13.6	7.3	0.3	0.5
Total Potential Yield	144.4	926.2	517.8	93.2	123.0

[1/] Marginal total does include areas classified inoperable.

(p.2, 1972 TMP - North Kaibab Block, Kaibab NF).

in capacity. This expanded capacity could be accommodated only if more smaller-sized materials were utilized by the mill along with a larger proportion of species other than ponderosa pine.

Again, the large amount of standard component acreage, relatively high site indices, and genetically superior trees make this timbershed a particularly good candidate for a potential yield timber management program. The successful development of such a program will rely, in part, on recognizing and enhancing the marginal profitability of using mixed conifers and making certain adjustments in the sale procedures.

5. Fuelwood Use

Fuelwood use, both commercial and free use, has increased dramatically on the forest over the last few years (Table V-15). The

Table V-15. Fuelwood Harvests.

	Commercial Sales (mbf)	Free Use (mbf)
1975	175	675
1976	145	2475
1977	375	2800
1978	280	2930
1979	760	4975
1980	290	6300

free-use program, in particular, has increased with many individuals coming from Utah and as far away as Nevada. Commercial operators generally ship to areas where local fuelwood is lacking or to outside the state. In Phoenix, ponderosa pine fuelwood sells for $85-95 a cord. In Las Vegas, Nevada and Los Angeles, California, the fuelwood brings higher prices at approximately $125 per cord. Locally, most fuelwood sells for approximately $45 per cord. The U.S. Forest Service charges the commercial cutters $3.75 per cord for the fuelwood raw material. Most of these commercial cutters prefer ponderosa pine rather than pinyon-juniper. They indicate that there are some sawing and splitting problems associated with pinyon-juniper and that their customers seem to prefer ponderosa pine.

Fuelwood in the free-use areas is primarily dead and down material, not slash. Each free-use user must obtain a permit which allows cutting of up to 13 cords. The Forest Service has encountered problems in controlling the location of free-use cutting. In particular, it has been difficult to prevent users from cutting snags left for wildlife or to have users cut in pinyon-juniper to enhance range forage production.

The fuelwood market then, may also provide opportunities to increase utilization in the mixed conifer type. At the same time, there would seem to be an opportunity for decreasing machine piling and burning costs for slash disposal. This could be done by opening logged areas to free-use fuelwood cutters. Cutover areas could either be accessed before or after piling. If opened afterwards, it would serve to reduce burning costs only. In either case, such a practice would promote the efficient use of the residual materials. Fuelwood

concentration yards, where logging residue is placed in one location, might also be used to increase utilization of slash. Also, it might be desirable to mark smaller-sized, low-quality material for commercial fuelwood operators, thereby increasing utilization while at the same time enhancing timber management.

6. Mill and Wood Product Markets

The timbershed boundaries correspond to the area that supplies raw material for the Kaibab Industries' mill located in Fredonia, Arizona. The Kaibab Industries' mill is a stationary full-time mill with a processing capacity of between 35.1 and 50 million board feet per year. Statistics published by the Arizona State Land Department (Arizona Land Marks, Vol. 8, Book 5, 1978) indicate a total of 250 employees. This is roughly 18% of the population of Fredonia and 16% of the population of nearby Kanab, UT. Processed lumber from the mill is kiln-dried and the mill has an operating radius from which it draws raw material of from 30 to 60 miles. The company does its own logging and most of its own log hauling. Equipment at the mill includes band headsaws, sash gang saws, ring debarker, edger, headrig, chipper, residue chipper, planer, and dry kilns. Ponderosa pine, Douglas-fir, white fir, and Engelmann spruce are the primary species that are processed at the mill from which it produces shop (40%), dimension (30%), common lumber (20%), and timbers (10%). The mill also has a bark and soil amendment plant which produces decorative bark and sawdust mixtures for soil improvement. Chips ($21.40/BDU f.o.b.) are shipped to Flagstaff, Arizona, by truck then transferred to rail cars to be transported to the Southwest Forest Industries' pulpmill located in Snowflake, Arizona. Sawdust is used to fire the mill's boiler system.

Planer shavings are either bagged for bedding or sold bulk for "presto logs." Some shavings are shipped to Albuquerque to a particleboard plant located there.

The pine is used to produce shop dimension and common lumber as well as timbers. True fir, Douglas-fir and spruce are used to produce dimension lumber. Most of this lumber is made up of the larger sizes, 8" to 12".

The company distributes much of its lumber through the corporate headquarters sales system in Phoenix, Arizona; Las Vegas, Nevada; Albuquerque, New Mexico, or in various locations in California and Texas. The rather remote location of the mill and lack of a railroad makes shipping to more distant markets, such as the Midwest, difficult. This situation could change given the deregulation of trucking rates and the new possibility of backhauls.

Recently weak housing markets have decreased prices and sales possibilities. WWPA lumber price indexes have increased relatively little over the past few years while costs have increased significantly. Last year, the company had to close its Eagle, Colorado mill and the Forest Products Division showed an operating loss of $3 million. At present, the mill operation, compared to other company operations, is marginal, at best.

7. Supply Schedules

The supply schedules given in Figures V-2 through V-5 illustrate the marginal costs for ponderosa pine and mixed conifer sawlogs at Fredonia. Figures V-6 and V-7 show the aggregate supply. These are long-run supply schedules in that they involve sawtimber values available over an extended period of time. Construction of the schedules

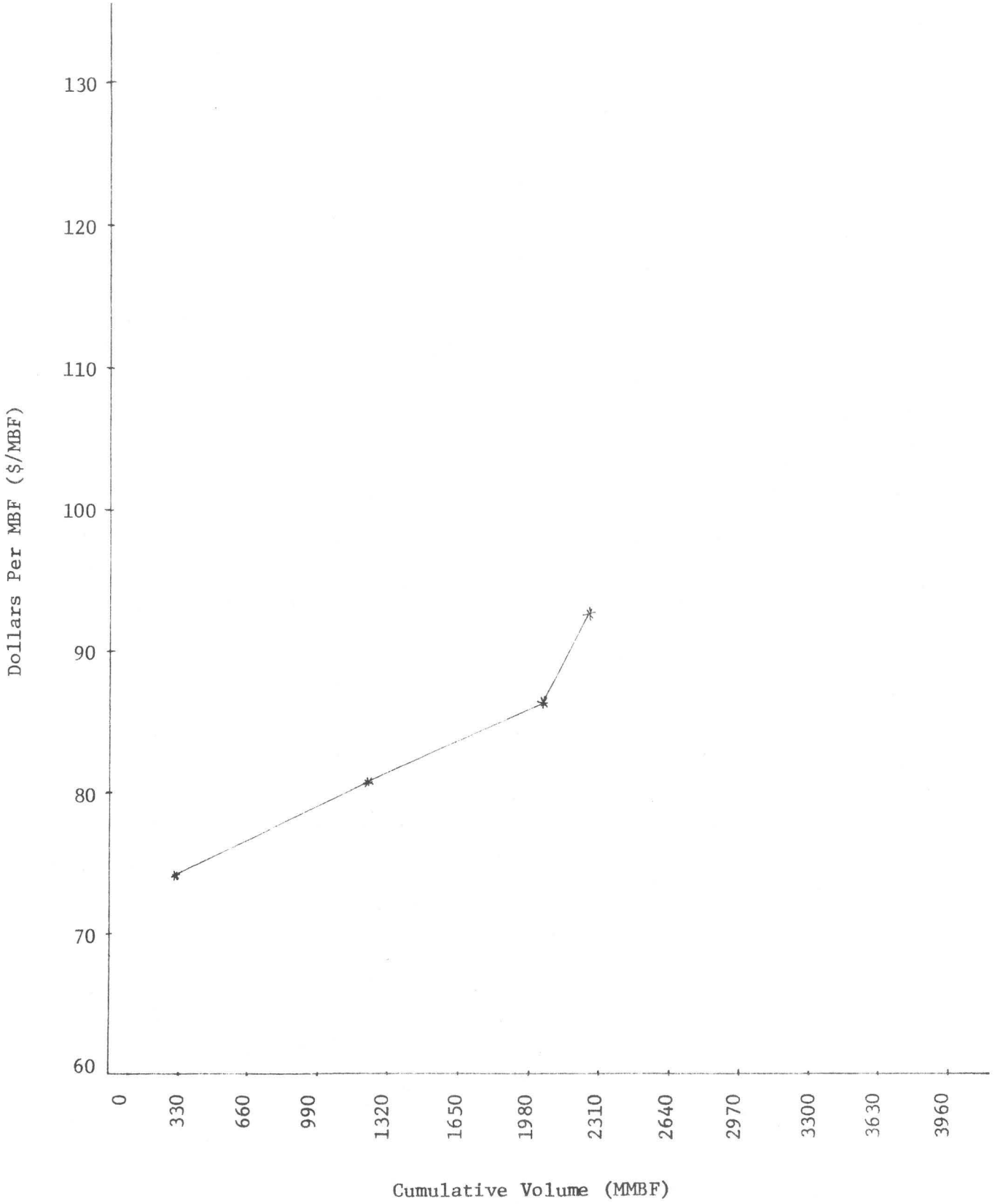


Figure V-2. Fredonia Ponderosa Pine Supply Schedule by Volume.

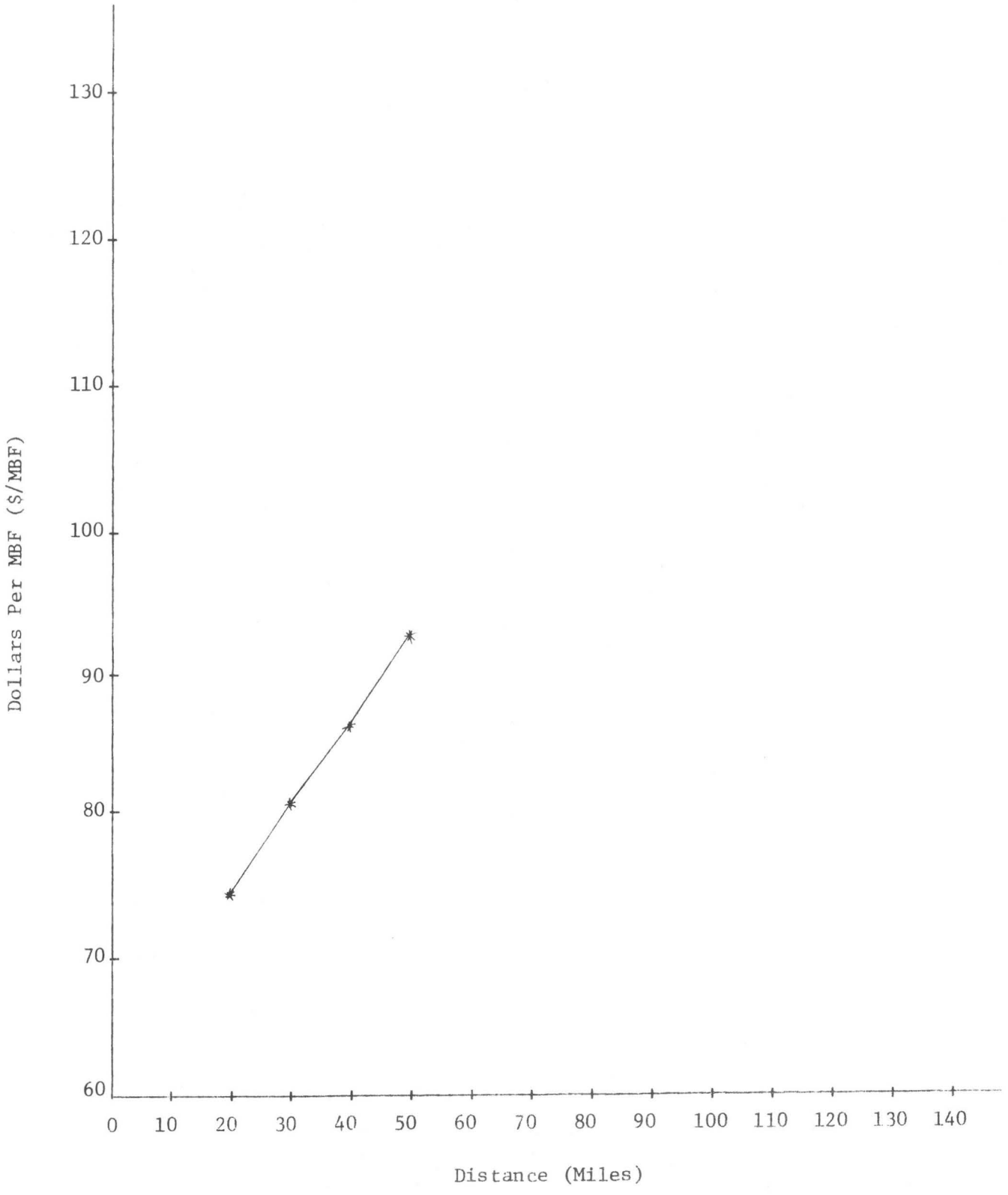


Figure V-3. Fredonia Ponderosa Pine Supply Schedule by Distance.

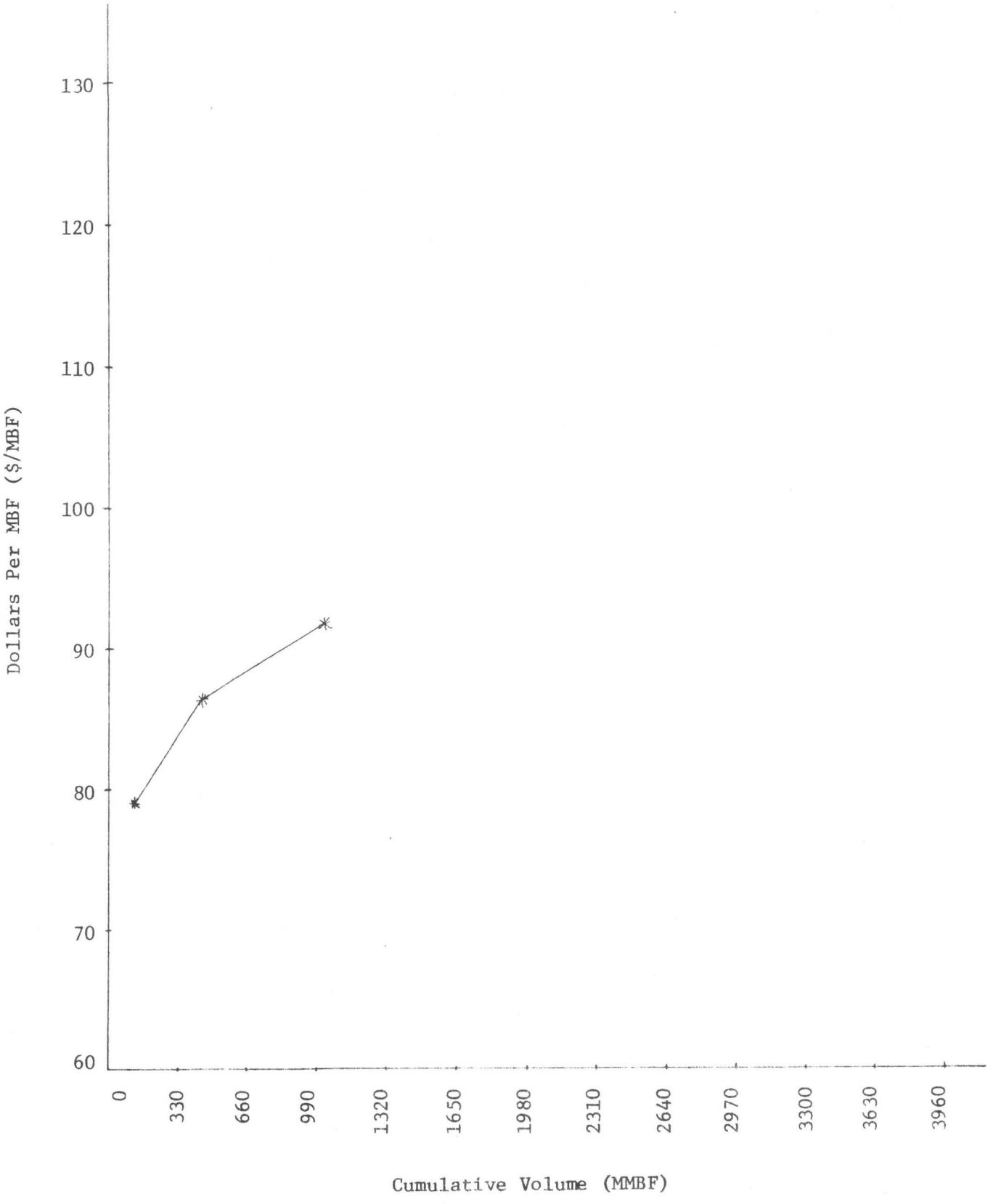


Figure V-4. Fredonia Mixed Conifer Supply Schedule by Volume.

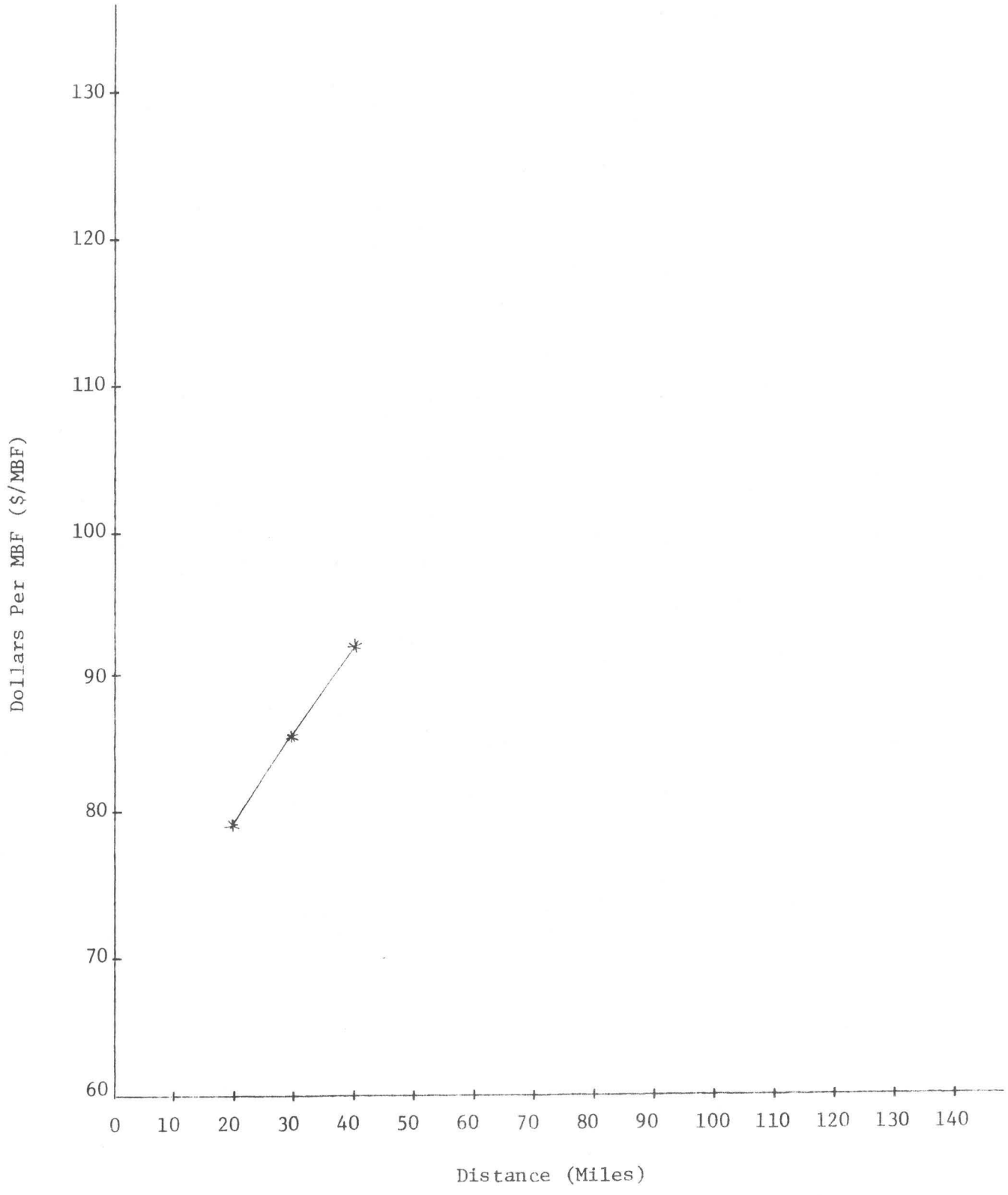


Figure V-5. Fredonia Mixed Conifer Supply Schedule by Distance.

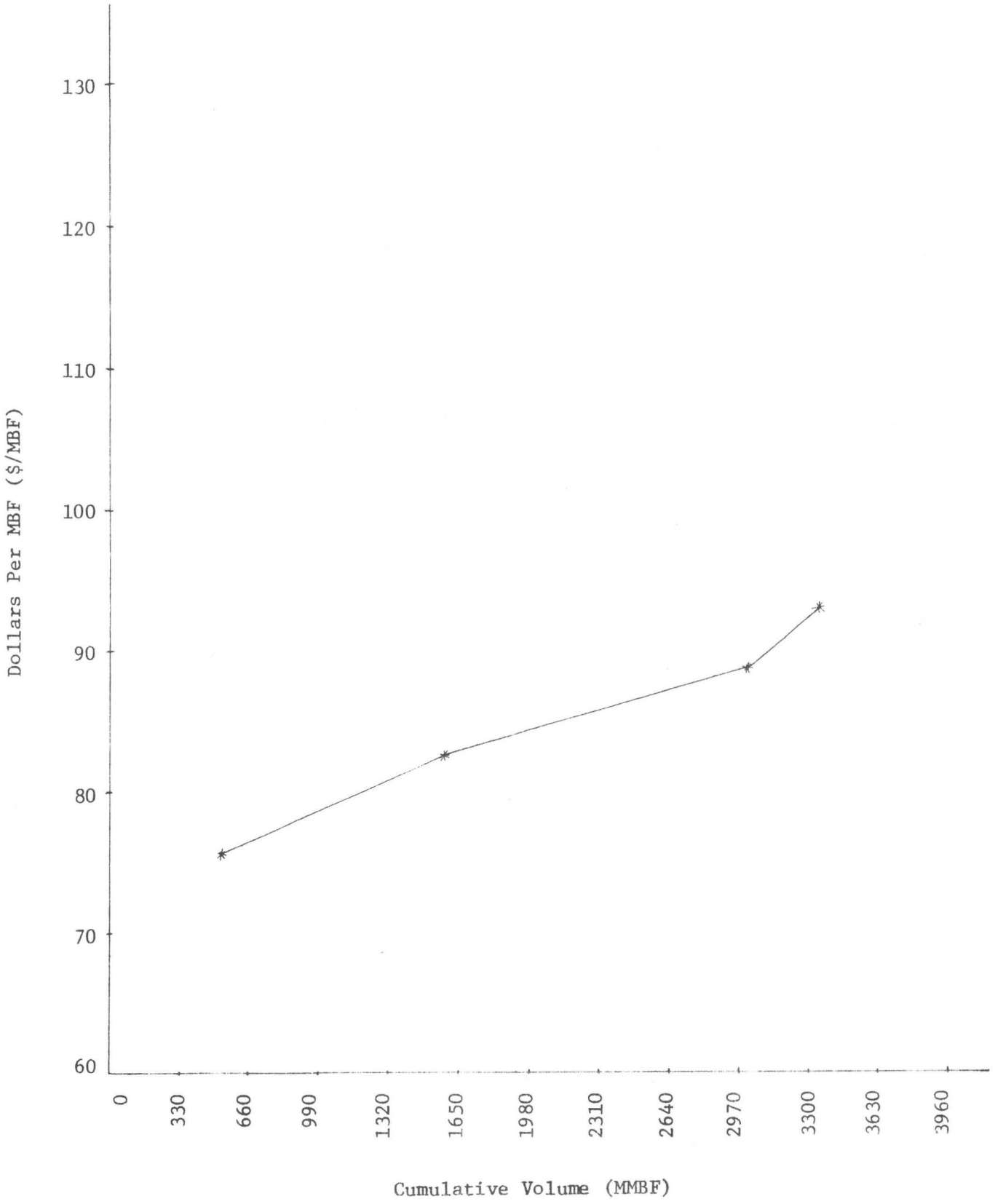


Figure V-6. Fredonia Aggregate Supply Schedule by Volume.

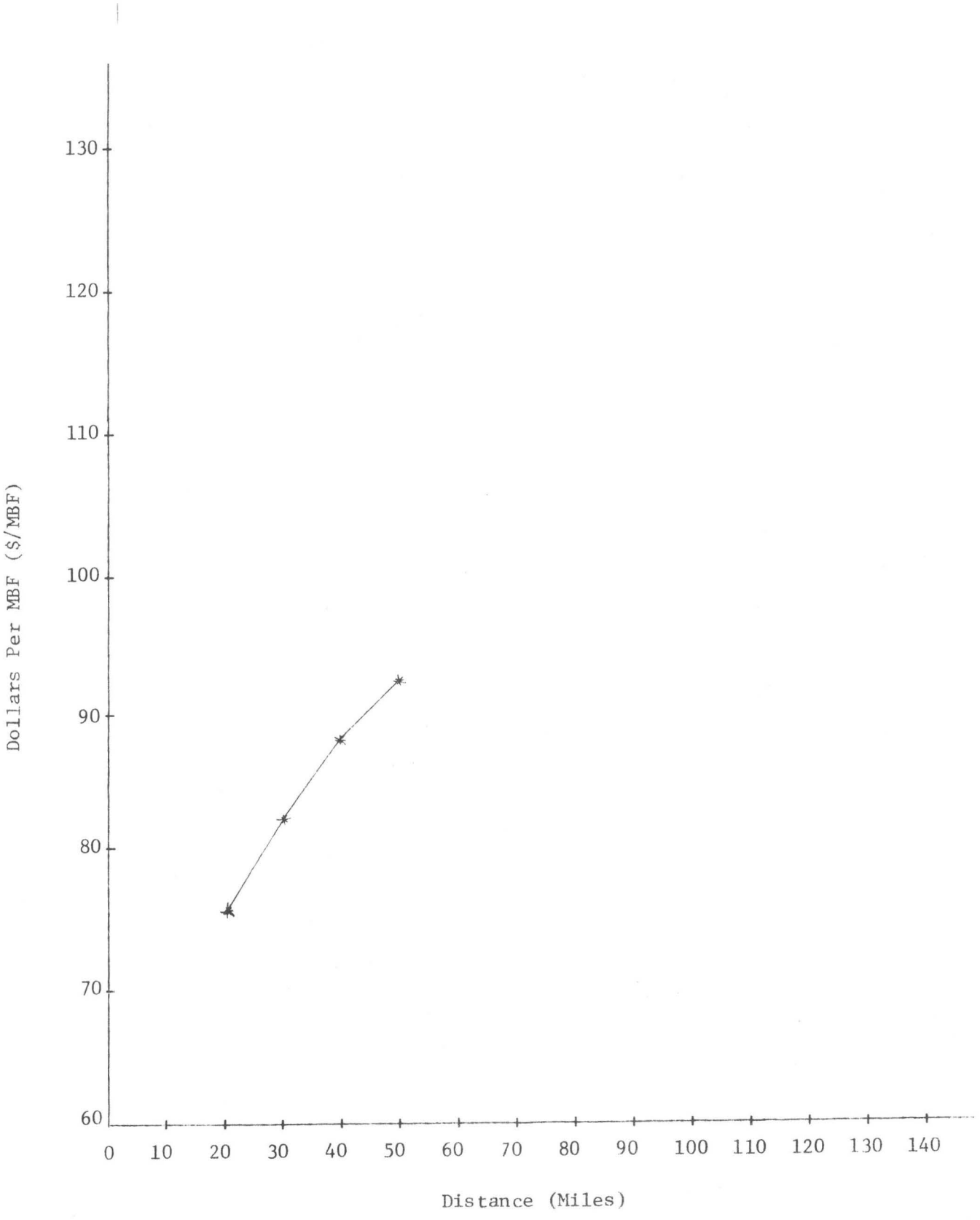


Figure V-7. Fredona Aggregate Supply Schedule by Distance.

can be broken down into two parts -- estimation of total costs and estimation of timber volume.

Total costs (components of total cost are based on averages for the timbershed) for logs delivered to the Fredonia mill include both logging and hauling costs. They do not include stumpage or road building costs. Stumpage costs are a function of other costs given the residual method of appraisal and road costs are extremely variable depending on sale characteristics. Logging costs used in the supply schedule were taken from Table V-10:

- Total ponderosa pine production costs w/o road costs ($/mbf)	$204.98
- Manufacturing costs for ponderosa pine ($/mbf)	-135.54
- Hauling costs for ponderosa pine ($/mbf)	- 16.45
Total logging cost for ponderosa pine	$ 52.99

Note that the hauling cost of $16.45 only represents the average haul cost for the previous sales analyzed. In lieu of the $16.45 figure, hauling costs as a function of distance are used in the timbershed supply schedules.

Hauling costs consist of both fixed and variable components. The fixed component results from driver delays associated with loading logging trucks. Based upon communications with USFS Region 3 engineers, two assumptions regarding the fixed component were made:

Driver pay averages $23 per hour;

and loading requires 13.63 minutes per mbf.

Thus, the fixed cost comes to approximately $5.22 per mbf.

The variable component includes fuel, tire, truck amortization, and operator costs. Table V-16 breaks these costs down based upon the

Table V-16. Breakdown of a Typical Trip to the Fredonia Mill.*

Road Type	$ per Roundtrip Mile/MBF	Road Description	% of Total Trip
Excellent	$0.39	2-lane gravel, excellent alignment, 0-4% grade, favorable	40%
Good	0.51	2-lane gravel, good alignment, semi-steep, 4-7% grade	9
Fair	0.55	2-lane gravel, good alignment steep grade	18
Poor	1.00	single-lane, graded and drained	33

*Based upon estimates for a typical 50 mile trip from sale to mill.

road conditions likely to be encountered for a typical haul in the Fredonia timbershed. From the percentages given in Table V-16, the distances covered on each road type were calculated for the mid-points of six distance classes (Table V-17). For example, in the 40 to 50 mile distance class, 40% of the mid-point distance of 45 miles, 18 miles, would be on excellent roads. Summing the costs for distances covered on each road type yields the total variable cost for a particular distance class (i.e., for the 40 to 50 mile class: 18.0 x 0.39 + 4.05 x 0.51 + 8.1 x 0.55 + 14.85 x 1.0 = $28.39).

In order to determine the volume of ponderosa pine and mixed conifers available within the distance classes, timber types for the timbershed were delineated on a 1:500000 scale Arizona state map. Then, using a planimeter, proportions of the total acreages in ponderosa pine and

Table V-17. Fredonia Timbershed Delivered Costs and Volume Distribution.

	Distance to Mill in Miles					
	0-10	10-20	20-30	30-40	40-50	50-60
Avg. Distance by Road Quality:						
Excellent	2.00	6.00	10.00	14.00	18.00	22.00
Good	0.45	1.35	2.25	3.15	4.05	4.95
Fair	0.90	2.70	4.50	6.30	8.10	9.90
Poor	1.65	4.95	8.25	11.55	14.85	18.15
Total Miles	5.00	15.00	25.00	35.00	45.00	55.00
Variable Round Trip Haul Cost (per MBF)	$ 3.15	$ 9.46	$15.77	$22.08	$28.39	$34.70
Fixed Haul Cost (per MBF)	$ 5.22	$ 5.22	$ 5.22	$ 5.22	$ 5.22	$ 5.22
Fixed Logging Cost (per MBF)	52.99	52.99	52.99	52.99	52.99	52.99
Total Cost (per MBF)	$61.36	$67.67	$73.48	$80.29	$86.60	$92.91
Total Volume (MBF)	-0-	-0-	687,103	4,009,751	575,213	11,417
Total Cumulative Volume (MBF)	-0-	-0-	687,103	1,696,854	2,272,067	2,283,484
Total Cost	-0-	-0-	$50,831,880	$ 81,072,908	$ 49,813,446	$ 1,060,753
Total Cummulative Cost	-0-	-0-	$50,831,880	$131,904,788	$181,718,234	$182,778,987
Average Cost/MBF	-0-	-0-	$73.98	$77.73	$79.98	$80.04

POND EROSA PINE

Table V-17. Cont.

		Distance to Mill in Miles					
		0-10	10-20	20-30	30-40	40-50	50-60
	Fixed Logging Cost	$58.29	$58.29	$58.29	$58.29	$58.29	$58.29
MIXED CONIFER	Total Cost/MBF	$66.66	$72.97	$79.28	$85.59	$91.90	$98.21
	Total Volume (MBF)	-0-	-0-	226,182	446,761	469,382	-0-
	Total Cumulative Volume (MBF)	-0-	-0-	226,182	672,943	1,142,325	-0-
	Total Cost	-0-	-0-	17,931,709	38,238,274	43,136,206	-0-
	Total Cumulative Cost	-0-	-0-	17,931,709	56,169,983	99,306,189	-0-
	Average Cost/MBF	-0-	-0-	$79.28	$83.47	$86.93	-0-

Fixed logging cost for MC:

218.21
-136.71
- 23.21
58.29

mixed conifers were estimated for each distance class. The final acreage and timber volume estimates found in Table V-18 resulted from multiplying the proportions by the total ponderosa pine and mixed conifer acreage and volume given in Table V-5.

Table V-18. Fredonia Timbershed Timber Distribution.

Distance (mi)	Acres PP	MC	Total
20-30	59,579	16,388	75,967
30-40	87,556	32,370	119,926
40-50	49,877	34,009	83,886
50-60	990	0	990
	198,002	82,767	280,769

Distance (mi)	Volume (mbf) PP	MC	Total
20-30	687,103	226,182	913,285
30-40	1,009,751	446,761	1,456,512
40-50	575,213	469,382	1,044,595
50-60	11,417	0	11,417
	2,283,484	1,142,325	3,425,809

Total costs and volume distributions give the basic information required to form the supply schedules. From them the marginal costs per mbf are calculated (Table V-19). By dividing total marginal costs by total marginal product for a distance class a marginal cost per mbf can be found. The final supply schedules are drawn with either cumulative volume or distance to the mill on the horizontal axis and ATC/mbf on the vertical axis.

Table V-19. Fredonia Supply Schedule Data

Ponderosa Pine

Distance	Cum. Vol (MBF)	Total Cum. Cost	MC	MP	$/MBF
10-20	0	0			
(20)	(343,551)		50,831,880	687,103	73.98
20-30	687,103	50,831,880			
(30)	(1,191,979)		81,072,908	1,009,751	80.29
30-40	1,696,854	131,904,788			
(40)	(1,984,461)		49,813,446	575,213	86.60
40-50	2,272,067	181,718,234			
(50)	(2,277,776)		1,060,753	11,417	92.91
50-60	2,283,484	182,778,987			

Mixed Conifer

Distance	Cum. Vol (MBF)	Total Cum. Cost	MC	MP	$/MBF
10-20	0	0			
	(113,091)		17,931,709	226,182	79.28
20-30	226,182	17,931,709			
	(449,563)		38,238,274	446,761	85.59
30-40	672,943	56,169,983			
	(907,634)		43,136,206	469,382	91.90
40-50	1,142,325	99,306,189			

Aggregate

Distance	Cum. Vol (MBF)	Total Cum. Cost	MC	MP	$/MBF
10-20	0	0			
	(456,643)		68,763,581	913,285	75.29
20-30	913,285	68,763,589			
	(1,641,541)		119,311,182	1,456,512	81.92
30-40	2,369,797	188,074,771			
	(2,892,095)		92,949,652	1,044,595	88.98
40-50	3,414,392	281,024,423			
	(3,420,101)		1,060,753	11,417	92.91
50-60	3,425,809	282,085,176			

When using cumulative volume it becomes necessary to find the average volume between the two distance classes under consideration. For example, the average cumulative volume of ponderosa pine between the 10-20 and 20-30 mile distance classes comes to (0 + 687.10)/2 = 343.55 mmbf. Thus, the first point plotted on the supply schedule in Figure V-2 is (344.55,74.00).

On the other hand, if the x-axis represents distance, the x coordinate would be the mid-point between the two distance classes of interest (i.e., for the $/mbf figure derived from the 10-20 and 20-30 mile classes the mid-point would be 20 miles). Therefore, the first point plotted in Figure V-3 is (20,74.00).

The rising supply schedules reflect the timbershed's heavy concentrations of ponderosa pine volumes. For example, up to a distance of approximately 30 miles there is a volume of ponderosa pine equivalent to the total mixed conifer volume in the timbershed. The procurement costs at various distances are approximately the same, averaging about $6 more per mbf for mixed conifers.

The supply schedules point out that additional sawlogs can be supplied to the mill but only with added costs. The cost-to-volume supply schedule for ponderosa pine (Fig. V-2) illustrates the typical "diminishing returns" situation where costs are increasing more rapidly than volumes available. This represents the typical inelastic supply situation where a percent change in price/cost will have less of an impact on percent change in volumes supplied. The mixed conifers, however, have the opposite situation occurring (Fig. V-4). In this case, the additional volumes available at greater distances tend to reduce the $/mbf costs.

The curves can be used to determine the mill's maximum profit position regarding sawlogs. If the price of sawlogs[1/] at the mill is less than the marginal cost (plus roads and stumpage) then the mill is making some profit. At the point where they are equal is the breakeven point. In this case, at any given sawlog price (f.o.b. Fredonia) the breakeven point is at a much further distance for ponderosa pine than it is for mixed conifers. For example, at a sawlog price of $85 the breakeven point is 38 miles for ponderosa pine and 29 miles for mixed conifers. For different sawlog values for each species the mill will be most efficient where the price of sawlogs is equal to the marginal costs (plus stumpage and roads). Mixes of species should be reorganized to develop this situation as prices (costs) change over time.

8. Problems and Opportunities

The major problems associated with utilizing more true fir, Douglas-fir and spruce from the mixed conifer type revolve around two major factors. First, the selling value of mixed conifer lumber products is generally less than those manufactured from ponderosa pine (approximately $200 per mbf vs. $300 per mbf) and second, logging and procurement costs are higher in the mixed conifer type than in the ponderosa pine type. For example, the Fredonia mill must currently pay loggers rates that are approximately 25 percent higher when logging the mixed conifers. The mixed conifer species, all in all, simply do not provide the margin for profitability that ponderosa pine does for wood products. This is further substantiated by the fact that total production costs, which include logging, environmental, hauling, and manufacturing costs, account

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1/ The price of sawlogs can be derived by subtracting lumber manufacturing costs plus overhead from lumber (f.o.b.) selling values.

for 69 percent of the selling value per mbf, in the mixed conifer, and 64 percent of the selling value for ponderosa pine.

Another problem that makes mixed conifer less desirable is the type of silvicultural prescriptions currently being utilized by the Forest Service. In certain cases, the mixed conifer prescriptions tend to emphasize the removal of trees that would likely become mortality trees or trees that are generally less desirable from a quality standpoint. This is done in an effort to enhance pine regeneration in the long run, but is also done at the expense of profits since it increases the utilization of the less desirable, lower value species. Thus, there is a dilemma regarding the marginal profitability of logging mixed conifers and timber management practices to enhance pine regeneration.

The solution to the mixed conifer related problems involves not only the mill associated wood utilization but also the U.S. Forest Service's prescriptions and timber appraisal procedures. Sales should be marked in such a way so as to provide for meeting silvicultural objectives while at the same time making it profitable for the mill to log. Generally, this means including a significant amount of pine in the sales. Determining what portion of the sale should be ponderosa pine involves carefully assessing the sale costs for each of the species on an individual basis. Appraisals currently use overall logging cost averages for the entire sale, not emphasizing species mix. Separate cost estimates for each species would allow for more accurate appraisals.

From a silvicultural point of view, it might be desirable to include areas in sales where windfirmness is a problem along with areas where it is not a problem. This could possibly serve to reduce overall logging costs to the operator as well as provide higher quality materials.

Another possibility for making mixed conifer sales more profitable would be to intersperse intermediate cuts with patch clearcuts.

Timber sales appraisal data from the Fredonia timbershed was analyzed in order to obtain insight regarding differences between mixed conifer sales and ponderosa pine sales. Analysis of ten sales showed that a statistically significant difference exists between mixed conifer and ponderosa pine sales in the areas of hauling distance and percent defect (see Table V-10). Both mean values were larger for the mixed conifer sales. This significant difference could perhaps warrant a more detailed breakdown of the costs associated with these areas in the appraisal process.

Additional possibilities for improving the desirability of mixed conifer sales in the Fredonia timbershed exist. One item which might be considered would be to appraise the small-sized material to the Panguitch mill if, in fact, this is the only mill presently capable of utilizing this material. Another possibility might be to increase the margin for profit and risk in the mixed conifer sales since the profit is smaller, making the sale more risky to the operator. Measures such as this could help to encourage investment in mill and capital equipment necessary to process the smaller-sized logs and/or to produce new product lines using the mixed conifer species. Given the current cost of capital, profitability must be increased and risk decreased in order to stimulate mill investments favorable towards utilization of mixed conifers.

All in all, the appraisal and sale arrangement should be carefully analyzed in order to determine a procedure which would meet the silvicultural requirements and, at the same time, provide an economically

viable opportunity for the operator. This might be a somewhat difficult process to develop but it must be used in order to further the utilization of mixed conifers.

To a lesser extent, promoting the use of the fuelwood market might also help utilization of poor quality or smaller-sized material. This could be done as part of a sawtimber sale or separately depending on the timber volumes and access. Fuelwood concentration yards have been used successfully in many areas of the United States to increase utilization of fuelwood raw material.

Wood utilization and profit can be improved by quickly identifying markets and responding to changes in markets. This is a problem for most mills in that it normally takes from 3-4 weeks between the time the decision is made to make a product and when the product is actually ready for delivery. This time estimate assumes the raw material is available as logs at the mill. The uncertainty in markets makes sales planning ahead of time difficult, particularly in today's economy. Perhaps better communication with builders' associations would help in planning for demand. This communication might also help to promote the use of certain types of products by designers. Markets for trusses, finger jointed dimension (vertical support), spacers, etc. could possibly be expanded allowing for better utilization of the lower quality mixed conifer material in a higher valued product.

The marginal profitability of some of the mixed conifer products make it imperative to seek markets which are close, avoiding large transportation-to-market costs. In the future, the Arizona and New Mexico "Sunbelt" is likely to have an expanding population. Energy-related transportation costs (fuel) are going to have a significant impact on

lumber prices. Firms located in the Southwest should enjoy a comparative advantage in these local "Sunbelt" markets. Emphasizing the development of these markets by actively pursuing close working relationships with local builders and home designers should help enhance the mill's profitability and the use of mixed conifer material.

One product line which would seem to have a strong future demand involves mine timbers, cribbing, and props. The northern Arizona area can serve some major coal mining needs in Arizona, Utah, and Colorado. Other diversified products that can utilize mixed conifer and/or smaller type material involve fence posts and poles, decorative fencing, excelsior, shipping crates, pallets, furniture stock, and door cores. Houselogs may also be a possibility. Most of these products require some specialized production equipment and tapping of market outlets other than residential or industrial construction. Developing such markets will require a more diversified, comprehensive product distribution system.

b. Eagar, Arizona

1. Timber Characteristics

The Eagar timbershed is located within the northern portions of the Apache National Forest and contains a total of 624,614 acres of commercial forestland. Included in the timbershed are the Alpine and Springerville ranger districts in Arizona and the Quemado and Luna districts in New Mexico (the districts in New Mexico are administered by the Gila National Forest). The acreage in the timbershed accounts for approximately 78 percent of the total commercial forest acreage in the Apache National Forest. The acreage not included is in the southern portion of the forest. The timbershed also contains sawtimber

volumes totalling 3,063,295 mbf or 75 percent of the Apache total of 4,076,476 mbf. When necessary, these percentages will be used to adjust acre and volume figures for the whole Apache National Forest to better represent those in the timbershed (Fig. V-8).

Of the 624,000 acres of commercial forest within the timbershed, a total of 520,000 acres or 83 percent are included in the Standard component. The Special and Marginal components include 18,000 and 86,000 acres or approximately 3 and 14 percent respectively (Table V-20). It is estimated that approximately 10-15 percent of the total mixed conifer acreage is on marginal lands. The Special component is composed of travel influence and water influence zones and Special Management Units while the marginal lands include fringe type sawtimber and lands inoperable given present economic conditions and available logging technology.

Four major forest types are present within the timbershed: ponderosa pine, mixed conifer, spruce-fir, and aspen. Respective acreage totals are 446,128, 77,515, 5,886 and 10,301 acres for each of the types. Mixed conifers make up 14 percent of the operable acres of the timbershed (Table V-21). The bulk of this acreage is in the Alpine and Springerville districts of the Apache National Forest (Table V-22). The mixed conifer acreage has considerably more volume per acre than does the ponderosa type.

The timbershed has a large acreage of virgin timber in the operable land category, 155,000 acres (Table V-23). This, in part, accounts for the significant amount of "oversized sawtimber" (Table V-24). Some of this timber is said to have diameters up to 40".

Tables V-25 and V-26 indicate that the ponderosa pine and mixed conifer types occupy a majority of both the Site I (89%) and Site II (99%) lands

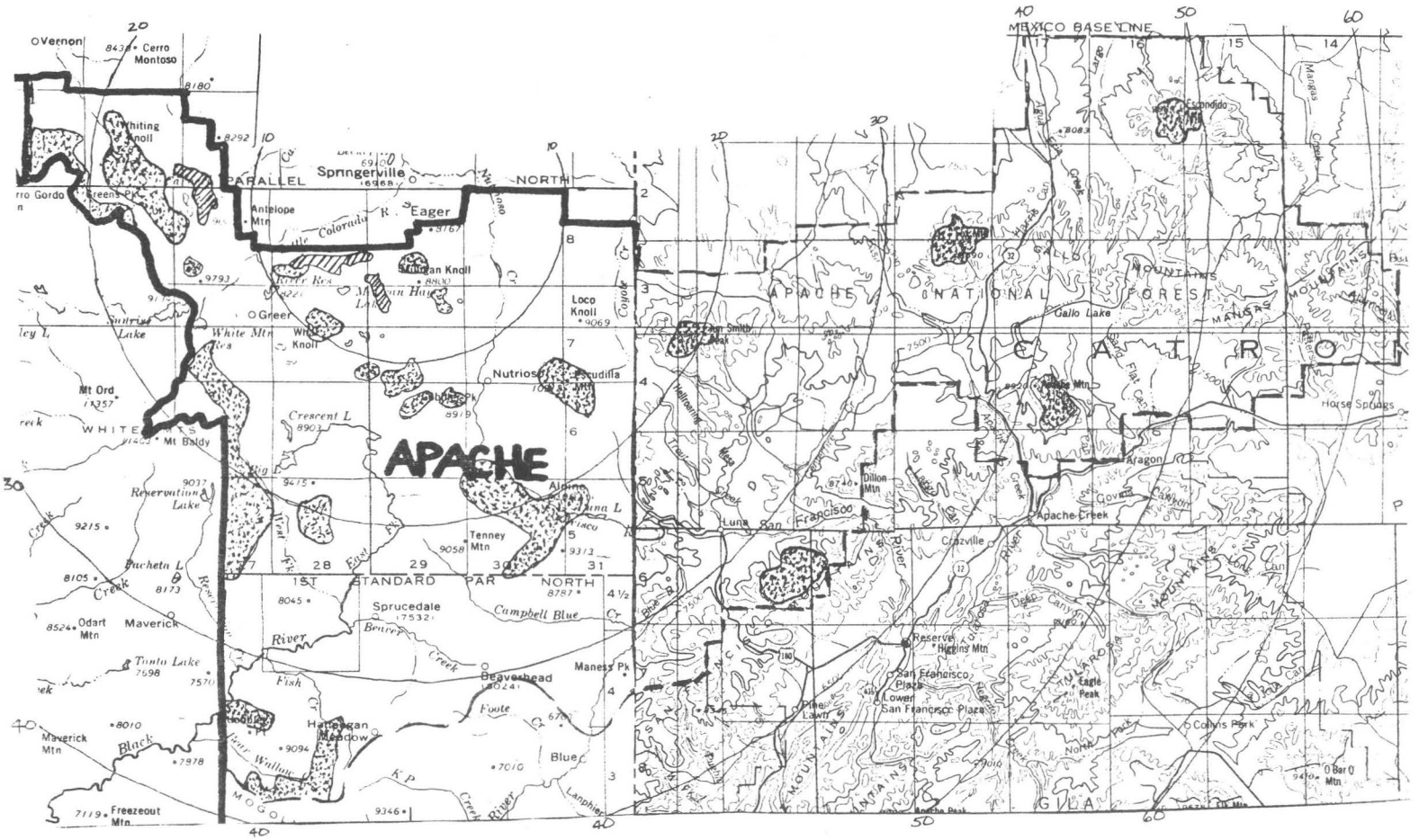

Figure V-8. Eagar Timbershed Characteristics.

Table V-20. Summary Statistics for Eagar Timbershed.

Land Use Classification[1]	M Acres	Volume (MBF)
Standard Component	520.7	-
Special Component	18.9	-
Marginal Component	86.1	-
Nonforested lands	736.5	-
Net Timber Volumes[1]		
Sawtimber		
Ponderosa pine	-	1,658,631
Mixed conifer	-	881,569
Spruce	-	42,103
Other[2]	-	27,261
Aspen	-	159,919
Total Potential Yield[1]		
Standard Component	39.6	45,800
Shelterwood	6.7	12,000
Intermediate	11.2	15,200
Preparatory	7.8	12,800
Salvage	-	6,000
Pulpwood	13.7	-
Watershed Study Areas	3.0	-
Special Component	.9	1,100
Marginal Component	5.5	5,900
Aspen	.2	-
Preparatory and Seed Cut	1.3	2,200
Removal	.8	1,400
Intermediate Cut	1.6	2,300
Pulpwood	1.6	-
Annual Allowable Harvest[1]		
Standard Component		
Shelterwood		
Seed Cuts	2.5	4,600
Removals	17.3	18,200
Intermediate	11.7	14,000
Preparatory	7.9	12,500
Salvage	-	5,100
Special Component		
Travel and Water Influence Zones	.6	1,100
Marginal Component	-	-

[1] Acre and volume figures in Eagar Timbershed based on 78 and 75 percent of totals for Apache National Forest respectively.

[2] Softwood component within aspen type.

Table V-21. Area by Major Forest Type (Operable Acres).

	Acres	Percent of Total
Ponderosa pine	446,128	83
Mixed conifer	77,515	14
Spruce-fir	5,886	1
Aspen	10,301	2
Total	539,830	100%

Source: Table 3, TMP, Apache N.F., 1976-1980.

Table V-22. Acres by Ground Type, Site Class, and District: Eagar Processing Center.

Ground Type	Total Acres	Site I	Site II	Site III
	Quemado and Luna Districts			
Ponderosa pine	247,757	10,411	172,536	64,810
Mixed conifer	8,814	-	8,579	235
Total Operable	256,571	10,411	181,115	65,045
Total Inoperable	35,016	-	21,405	13,611
	Alpine District			
Ponderosa pine	138,874	38,347	87,854	12,673
Mixed conifer	42,087	27,242	14,066	799
Spruce-fir	4,515	2,209	2,306	-
Aspen	8,174	7,905	269	-
Total Operable	193,650	75,703	104,495	13,452
Total Inoperable	25,468	16,214	9,265	-
	Springerville District			
Ponderosa pine	77,909	19,827	47,277	10,805
Mixed conifer	28,299	10,377	15,696	2,226
Spruce-fir	1,786	1,786	-	-
Aspen	2,127	1,461	666	-
Total Operable	110,121	33,451	63,639	13,031
Total Inoperable	3,788	2,683	1,105	-
	Timbershed Totals			
Operable	560,342	119,565	349,249	91,528
Inoperable	64,272	18,897	31,764	13,611
Totals	624,614	138,462	381,013	105,139

Source: Table 2, pps. A-3, A-4, A-11, TMP, Apache N.F.

Table V-23. Acres of Commercial Forestland and Sawtimber Volumes by Operability and Forest Types: Eagar Processing Center.

	Acres	Volume (MBF)[1/]
Total Commercial Forest	624,614	3,063,295
Inoperable	64,272	287,874
Operable	560,342	2,769,483
Softwoods		2,609,564
Cutover		1,577,957
Ponderosa pine	310,775	1,096,184
Mixed conifer	59,123	458,189
Spruce	3,845	23,583
Virgin		1,004,346
Ponderosa pine	135,353	562,447
Mixed conifer	18,392	423,380
Spruce	2,041	18,520
Non Stocked	20,512	-
Aspen[2/]	-	27,261
Hardwoods		
Aspen type	10,301	159,919

Source: Table 3, TMP, Apache N.F., 1976-1980.

[1/] 9.0" D.B.H.+. All volume figures are 75 percent of totals for the Apache N.F. This has resulted in some rounding error.

[2/] Softwood volume and acres contained within aspen type.

Table V-24. Sawtimber Volumes by Size Class, Eagar Processing Center.

Size Class	Sawtimber 9.0"+DBH[1/] MBF	Cubic Foot 5.0"+DBH[2/] MCF
Seedlings and Saplings (0.0-4.9")	N/A	N/A
Small Poles (5.0-8.9")	N/A	51,501
Large Poles (9.0-10.9")	82,950	35,954
Small Sawtimber (11.0-15.9")	521,277	136,525
Large Sawtimber (16.0-19.9")	648,268	143,120
Oversize Sawtimber (20.0+")	1,395,549	252,549

Source: Table 4, TMP, Apache N.F., 1976-1980.

[1/] Variable sawlog Top Limit.

[2/] To a 4.0" Top D.I.B.

Table V-25. Acres by Forest Type by Site Class.[1/]

Forest Type	Site Class		
	I	II	III
Ponderosa pine	80,962	323,964	96,451
Mixed conifer	60,745	39,957	9,988
Spruce-fir	4,003	2,115	-
Aspen	13,373	1,691	-

Source: Table 6, TMP, Apache N.F., 1976-1980.

[1/] Contains 109,915 acres of commercial Forest not included in Eagar Timbershed.

Table V-26. Percentage of Site Class by Forest Type.[1/]

Forest Type	Site Class		
	I	II	III
Ponderosa	51	88	91
Mixed conifer	38	11	9
Spruce-fir	3	.5	-
Aspen	8	.5	-

Source: Table 6, TMP, Apache N.F., 1971-1980.

[1/] Contains 109,915 acres of commercial forest not included in Eagar Timbershed.

found on the Apache National Forest. The majority of Site I lands within the timbershed are occupied by the ponderosa pine type (69,000 acres). There is also a total of 37,000 Site I acres occupied by the mixed conifer type. Although the total acreage of Site I lands is higher for ponderosa pine proportionally, by type, mixed conifer has a much larger percentage of Site I land, 50% vs. 15%.

Intensive management applied to these lands could result in substantial increases in merchantable yields in the future. This will become more important as the older timber within the timbershed is harvested and the forest approaches a regulated condition.

2. Silvicultural Prescription

In the timbershed, even-aged management is applied to lands within the Standard component. Harvest is accomplished through the use of regeneration, intermediate, and removal cuts (Table V-27). Regeneration cuts include patch, strip, and group shelterwood cuts. Intermediate harvests include thinning, salvage, and improvement cuts while the removal harvest is the third cut of the three-cut shelterwood system. Where dwarf mistletoe is a problem, patch cutting is used instead of shelterwood prescriptions. Within the Special component, prescriptions include both intermediate and salvage cuts as well as some irregular and group shelterwood cuts designed to retain a percentage of the stand as old growth.

3. Timber Procurement

This timbershed involves forests under the "Colorado Plateau Contract" which means all timber sale contracts specify utilization to a 6" top. Most sales are set up for concurrent logging involving both pulpwood and sawtimber. The sawtimber averaged 24" and pulpwood 5"-12".

Table V-27. Coordinated Allowable Annual Harvest by Component and Type of Harvest, Eagar Timbershed.

	M Acres[1/]	Sawtimber MMBF[1/]
Standard Component		
Shelterwood		
Seed Cuts	2.5	4.6
Removals	17.3	18.2
Intermediate	11.7	14.0
Preparatory	7.9	12.5
Salvage	-	5.1
Special Component		
Travel and Water		
Influence Zones	.6	1.1
Marginal Component	-	-

Source: TMP, Apache N.F., 1976-1980, pps. 13, 14.

[1/] Acre and volume figures for Eagar timbershed based on 78 and 75 percent of total for Apache National Forest respectively.

The success of this integrated approach depends primarily on the pulpwood market. Where strong demand exists, material less than 6" is chipped and sent to the pulpmill.

All sales currently involve "yum" yarding. That is, slash is piled and in most cases burned. If slopes are over 25% the slash is lopped and burned. In most cases, 10-15 tons/acre are left as residue in mixed conifer sales and less than 10 tons/acre in ponderosa pine sales. What is utilizable or unutilizable and left on the site depends primarily on the pulpwood market at the time. It is felt that improved utilization could develop if in-woods chipping was used.

In the past, cutting was done by conventional logging means. In general, the logging costs have been more expensive in the mixed conifer sales but not significantly so. For scaled sales, the extra scaling time for mixed conifers makes the administrative costs considerably higher, 25% or more than for pine sales.

According to Forest personnel, the mixed conifers are generally located on steeper slopes. There is one cable logging sale (13 mmbf) currently in the sale schedule. This will be the first such sale in the timbershed. There could be as much as 4 mmbf offered on a sustained basis as cable logging sales. Most of these sales would involve the mixed conifer type. Initially these sales will be scheduled for areas that will yield at least 5 mbf/acre. The cuts will be no larger than 20 acres in size with a maximum of 400 yards of yarding cable. The costs are not expected to be significantly higher even though there are steep slopes, because tree timber size is larger and this is expected to offset other costs.

According to the mills, the present procurement problems primarily involve not making the pulpwood sales heavy enough. The length of the

harvest season, generally three months, is also a problem for the mills. At present, the mills feel the cost difference between ponderosa pine and mixed conifers is slightly higher but not significantly so. They estimate stumpage price to be about 50 percent of the total cost of getting logs to the mill; the logging and hauling makes up the other half. In certain cases there is competition in bidding for sales. The difference between minimum advertised sales and bid prices is most different in the mixed conifer species (this seems to be part of a bidding strategy rather than an indication of individual species preferences). There are certain sales administered as small business set-asides.

The statistical analysis of costs and sale characteristics indicated that there were no major differences between variables dealing with wood procurement (Tables V-28 and V-29). This verifies both the U.S. Forest Service and the mill personnel's opinion that the costs were the same. The timber dbh size and level of defect were also reasonably the same. However, the size of mixed conifer sales was generally smaller.

There was, however, a statistically significant difference in lumber selling values. Mixed conifer lumber was worth significantly less than ponderosa pine. Even with total costs being relatively the same, this difference in selling values creates a problem for the mills. Table V-28 shows mixed conifers' total cost (w/o roads) makes up 72 percent of lumber selling value, whereas, ponderosa pine makes up 62 percent. Thus, the margin for profitability is 10 percent less in the case of mixed conifers' use for wood products.

Table V-28. Eagar Timbershed Sales Statistics Broken Down by Species.

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between Means
1. Acres					
Mixed conifer	Acres	1,380.3	187- 3,509	1,443.6	Yes
Ponderosa pine		6,747.75	3,030-11,318	3,447.02	
2. Sale volume					
Mixed conifer	Scribner MBF	6,115.6	199.0-15,990.0	5,539.5	No
Ponderosa pine		13,480.0	5,470.0-22,700.0	8,588.79	
3. Average sale DBH					
Mixed conifer	Inches	21.29	14.0-26.0	8.32	No
Ponderosa pine		21.13	20.0-24.5	2.25	
4. Average sale defect					
Mixed conifer	Percent	18.0%	12.0-25.0%	4.69	No
Ponderosa pine		15.2	7.6-24.5	8.16	
5. Average overrun					
Mixed conifer	Percent	29.19%	23.49-32.53%	3.86	No
Ponderosa pine		30.98	29.65-32.05	1.04	
6. Hauling distance sale-to-mill					
Mixed conifer	Miles	30.0	21.0 -36.0	5.77	Yes
Ponderosa pine		18.5	3.0 -31.0	12.56	
7. Hauling cost sale-to-mill					
Mixed conifer	Cost per MBF	$ 19.79	$ 15.37- 23.54	3.14	No
Ponderosa pine		21.28	17.63- 27.27	4.57	

Table V-28 (con't).

Variables and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between Means
8. Selling value, lumber tally					
Mixed conifer	$ per MBF	$184.09	$170.60-210.13	14.01	Yes
Ponderosa pine		267.42	217.56-289.77	33.55	
9. Selling value, log scale					
Mixed conifer	$ per MBF	$304.10	$276.53-335.26	25.67	Yes
Ponderosa pine		368.63	344.68-409.40	28.38	
10. Stump-to-truck, logging cost					
Mixed conifer	Cost per MBF	$ 34.20	$ 19.88- 57.46	11.78	No
Ponderosa pine		38.19	24.92- 43.65	8.88	
11. Environmental protection					
Mixed conifer	Cost per MBF	$ 17.78	$ 7.07- 37.46	12.87	No
Ponderosa pine		30.44	15.63- 40.84	11.51	
12. Temporary road cost					
Mixed conifer	Cost per MBF	$ .81	$ 0.00- 4.12	1.50	No
Ponderosa pine		.22	0.14- 0.36	0.10	
13. Temporary road requirements					
Mixed conifer	Miles	1.18	0.0- 3.0	1.42	Yes
Ponderosa pine		7.10	3.4- 10.8	3.08	

Table V-28 (con't).

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between Means
14. Specified road cost					
Mixed conifer	Cost per MBF	$ 14.41	$0.00-36.21	13.17	No
Ponderosa pine		42.61	0.00-64.34	29.40	
15. Specified road requirements					
Mixed conifer	Miles	3.47	0.0 - 6.7	3.06	No
Ponderosa pine		2.90	0.0 - 6.9	3.12	
16. Slash Piling cost					
Mixed conifer	Cost per acre	$ 54.23	$44.26-65.55	7.19	No
Ponderosa pine		40.93	28.12-54.42	11.78	
17. Slash lopping and scattering cost					
Mixed conifer	Cost per acre	$ 25.02	$ 8.25-56.63	15.99	No
Ponderosa pine		22.86	22.10-23.61	1.07	
18. Total slash disposal cost					
Mixed conifer	Cost per MBF	$ 16.51	$ 6.02-36.68	12.59	No
Ponderosa pine		29.63	15.14-38.80	11.00	
19. Road maintenance cost					
Mixed conifer	Cost per MBF	$ 1.46	$ .49- 2.50	.79	Yes
Ponderosa pine		3.97	2.63- 5.62	1.24	

Table V-28 (con't).

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between Means
20. General logging overhead					
Mixed conifer	Cost per MBF	$ 11.18	$ 9.45- 13.26	1.33	Yes
Ponderosa pine		13.54	12.78- 15.35	1.23	
21. Manufacturing cost					
Mixed conifer	Cost per MBF	$144.59	$115.70-260.20	51.62	No
Ponderosa pine		149.08	142.73-163.92	10.00	
22. Total production cost with road cost					
Mixed conifer	Cost per MBF	$233.04	$173.39-358.25	61.92	No
Ponderosa pine		285.79	258.95-299.04	18.32	
23. Total production cost w/o road cost					
Mixed conifer	Cost per MBF	$218.64	$173.39-332.04	57.89	No
Ponderosa pine		242.96	229.47-258.81	13.43	
24. Average Advertised rate					
Mixed conifer	$ per MBF	$ 83.35	$ 16.80-129.78	41.14	No
Ponderosa pine		92.69	53.49-163.32	48.52	

Table V-28 (con't).

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between Means
25. Average advertised rate divided by total production cost					
Mixed conifer	Percent	41.5%	6.6-69.5%	24.2	No
Ponderosa pine		38.9	20.7-71.2	22.3	
26. Average advertised rate divided by selling value, log scale					
Mixed conifer	Percent	27 %	6.1-38.7%	12.5	No
Ponderosa pine		24.5%	15.5-39.9	10.7	
27. Total production cost w/o road cost divided by selling value, log scale					
Mixed conifer	Percent	71.9%	54.9-99.0%	17.4	No
Ponderosa pine		66.3	56.1-75.1	7.9	

Table V-29. Summary Statistics for Eagar Timbershed, All Sales Combined Regardless of Species (all figures adjusted to 1980 dollars).

Variable	Unit of Measure	Mean Value	Range	Standard Deviation
1. Acres	Acres	3,332	187-11,318	3,485.44
2. Sale volume	Scribner MBF	8,793	199-22,700	7,372.03
3. Average sale DBH	Inches	21.23	14.0-26.0	3.20
4. Average sale defect	Percent	17.0%	7.6-25.0%	5.93
5. Average overrun	Percent	29.84%	23.49-32.53%	3.18
6. Hauling distance, sale-to-mill	Miles	25.82	3.0-36.0	10.05
7. Selling value, lumber tally	$ per MBF	$214.39	$170.60-289.77	47.15
8. Selling value, log scale	$ per MBF	$327.56	$276.53-409.40	41.19
9. Stump-to-truck logging cost	Cost per MBF	$ 35.65	$ 19.88- 57.46	10.54
10. Environmental protection cost	Cost per MBF	$ 22.38	$ 7.07- 40.84	13.41
11. Temporary road cost	Cost per MBF	$ .60	$ 0.00- 4.12	1.20
12. Temporary road requirements	Miles	3.55	0.0-10.8	3.69

Table V-29 (con't).

Variable	Unit of Measure	Mean Value	Range	Standard Deviation
13. Specified road costs	Cost per MBF	$ 24.66	$ 0.00- 64.34	23.79
14. Specified road requirements	Miles	3.26	0.0-6.90	2.93
15. Slash piling cost	Cost per acre	$ 48.91	$ 28.12- 65.55	11.05
16. Slash lopping and scattering cost	Cost per acre	$ 24.54	$ 8.25- 56.63	13.88
17. Total slash disposal cost	Cost per MBF	$ 21.07	$ 6.02- 38.80	13.10
18. Road maintenance cost	Cost per MBF	$ 2.38	$ .49- 5.62	1.56
19. Hauling cost, sale-to-mill	Cost per MBF	$ 20.33	$ 15.37- 27.27	3.57
20. General logging overhead cost	Cost per MBF	$ 12.04	$ 9.45- 15.35	1.71
21. Manufacturing cost	Cost per MBF	$146.22	$115.70-260.20	40.42
22. Total production cost with road costs	Cost per MBF	$252.23	$173.39-358.25	55.76
23. Total production cost without road costs	Cost per MBF	$226.97	$172.52-331.46	44.03

Table V-29 (con't).

Variable	Unit of Measure	Mean Value	Range	Standard Deviation
24. Average advertised rate	$ per MBF	$ 86.75	$ 16.80-163.32	41.76
25. Average advertised rate divided by total production cost without road costs	Percent	40.6%	6.7-81.2%	22.40
26. Total production cost without road cost divided by selling value, log scale	Percent	69.7%	54.7-99.0%	14.20

4. Actual Cut, Programmed Cut, and Potential Yield

While historical data is not available to reveal general trends in the allowable cut level, it is shown in Table V-30 that the actual cut on the Apache remained relatively constant over the years 1967 to 1980. Exceptions occurred in 1979 when the actual cut increased by 27 million board feet over the previous year to 117.3 mmbf and in 1973 when it declined to 68.9 million feet from 1972 levels. These actual cut levels closely follow the fluctuations in the national housing market. It is at its lowest in 1980.

The actual cut over the last ten years has averaged about 55 mmbf per year. This is about 15 mmbf more than what is expected in the new timber management plan. There has been some cutting over the allowable cut because of salvage operations. The Forest personnel estimate a 10 percent reduction in cut due to recreation and wildlife considerations in the new forest plan. The present allowable cut and actual cut are approximately the same. Thus, it seems that in the future the mills can look for somewhat less sawtimber being available (unless cable sales are expanded).

The U.S. Forest Service personnel feel the existing mill capacity (with new Southwest mill in Eagar) is large enough to support a potential yield program in the timbershed. This potential yield program includes both sawtimber and pulpwood markets. The total potential yield volume for the timbershed would include 53 mmbf of sawtimber and 30,000 cords of pulpwood (Table V-31). The potential sawtimber yield is about the same as the actual cut.

Table V-30. Trends in Actual Harvest: Apache National Forest.

Fiscal Year	Volume cut (MMBF)
1965	55.4
1966	67.6
1967	86.1
1968	90.7
1969	117.3
1970	90.2
1971	74.7
1972	79.7
1973	68.9
1974	80.4
1975	49.3
1976	50.2
1977	57.9
1978	48.2
1979	35.9
1980	40.8

Source: TMP, Apache N.F., 1976-1980. pp.20.

Table V-31. Potential Yield, Eagar Timbershed.[1/]

Management Component	Acres (M)	Sawtimber MMBF	Products M cunits	Products M cords
Standard-Total	39.6	45.8	18.0	23.6
Shelterwood				
Seed Cuts	1.2	1.4	-	-
Removals	5.5	10.6	-	-
Intermediate	11.2	15.2	-	-
Preparatory	7.8	12.8	-	-
Salvage	-	6.0	-	-
Pulpwood	13.7	-	18.0	23.6
Watershed Study Areas	3.0	-	-	-
Special-Total	.9	1.1	-	-
Marginal-Total	5.5	5.9	5.3	6.5
Aspen	.2	-	3.5	4.0
Prep. and Seed Cut	1.3	2.2	-	-
Removal	.8	1.4	-	-
Intermediate Cut	1.6	2.3	-	-
Pulpwood	1.6	-	1.8	2.5

Source: TMP, Apache N.F., 1976-1980, p. 5.

[1/] Acre and volume figures for Eagar timbershed based on 78 and 75 percent of Apache N.F. totals respectively.

In general, given the local pulpwood market, this timbershed has a better chance of developing a potential yield program than others in the two states.

5. Fuelwood Use

The timbershed does have a good deal of "free-use" fuelwood procurement, much more so than commercial fuelwood cutting (Table V-32). The Apache Forest is some distance from major population centers where there are closer sources of raw material (e.g., the Sitgreaves N.F. closer to Phoenix) for commercial cutters. Further the pulpmill pays $82/cord for roundwood, thus there is a strong local market for fuelwood operators to compete with. Although it is impossible to tell for sure, there might be certain individuals who cut "free use" fuelwood and deliver it to Snowflake for pulpwood. Given the increases in free use cutting this market could be used to help the utilization of "yum" material as well as the application of thinning or removal of trees unsuitable for more traditional wood products.

Table V-32. Fuelwood Harvests

	Free Use	Commercial
1978	2.4 mbm	5709 cords
1979	44.6 mbm	5800 cords
1980	52.5 mbm	3817 cords

6. Mill and Wood Product Markets

The Eagar timbershed supplies the majority of raw material for the Southwest Forest Industries mill and several small mills in and around Eagar, Arizona. The Southwest mill in Eagar is by far the largest local

timber user and employs 40% of Eagar's population. This mill is a stationary, full-time mill with an annual capacity ranging between 15.1 and 35 million board feet. This mill is currently being renovated ($19.6 million investment) to increase its potential capacity to 80 mmbf. This will replace a company mill in McNary, Arizona which was destroyed by fire late in 1979.

In addition to the Eagar mill, Southwest Forest Industries has a smaller sawmill (17 mm capacity) in Reserve, N.M. The mill in Eagar sends a large portion of its mixed conifer logs to the Reserve mill to be processed. The Reserve mill, in turn, sends all its lumber to Eagar, for drying and planing. These sawmills complement the pulp and paper plant in Snowflake in that it uses their mill residues. This pulp and paper plant produces linerboard. The company is now reducing this linerboard capacity and is increasing newsprint capacity. Newsprint can use waste newsprint as a substitute for woodchips. This will reduce the company's reliance on woodchips as sawmill output declines in recessionary times. The newsprint will also take advantage of the growing "Sunbelt" publishing market.

The Eagar sawmill produces lumber which is kiln-dried, air-dried, or green. Most of the lumber produced is dimension, with an average price of $290/mbf f.o.b. There are also some utility poles, guard rails and posts produced. The bulk of the dimension material is produced from mixed conifers. The Douglas-fir is sold "surface green" while all other products are kiln-dried to about 15-16%.

Ponderosa pine (65% of volume), Douglas-fir/white fir (35%) of volume are the mix of products processed at the mill. Aspen is also used to a limited degree to produce shakes and excelsior. One hundred

percent of the local mill's timber is procured from U.S. Forest Service lands.

Equipment located at the Southwest mill includes a band headsaw, sash gang saw, rosser debarker, edger, residue chipper, planer, and dry kiln. All chips are sent to the pulpmill located in Snowflake, Arizona. Chips are presently worth $75/ODU f.o.b. and roundwood about $82/cord f.o.b. Most sawdust is used at the sawmill for kilns and boilers. Shavings and dry sawdust are shipped to the particleboard plant in Albuquerque, New Mexico.

As with mills throughout the Rocky Mountains, the present housing slump and rising cost of capital are the most immediate problems. The uncertainty of future markets has made planning even more difficult.

Southwest Industries has extensive wholesaling and retailing operators. The company recently purchased a lumber retailing company having outlets in Minnesota and the Dakotas. Presently, the mill ships to markets in the Midwest and to Phoenix, Arizona; Los Angeles, California; and Texas. The better quality material (about 10% of volume) is distributed directly to remanufacturing plants for windows (Anderson Windows in Midwest) and door frames (Flagstaff, Arizona). Other boards and dimension material are marketed through wholesalers (65% of total volume). This lumber is shipped primarily by truck (70%) for closer markets and by rail to the Midwest (30%). All the products produced from mixed conifers are shipped by truck. About 70% of the ponderosa pine is shipped by truck and 30% by rail depending on customer preference and costs.

7. Supply Schedules

The timbershed volume/acreage distribution for mixed conifer and ponderosa pine is shown in Table V-33. The cost per mbf is shown in

Table V-33. Eagar Timbershed Acreage and Volume Distribution.

Distance	Acres			Volume (MBF)		
	Ponderosa	MC	Total	Ponderosa	MC	Total
0-10	40,152	3,488	43,640	149,277	39,671	188,948
10-20	127,593	35,812	163,405	474,368	407,285	881,653
20-30	115,101	27,750	142,851	427,927	315,602	743,529
30-40	80,303	10,465	90,768	298,554	119,012	417,566
40-50	49,074	0	49,074	182,449	0	182,449
50-60	29,444	0	29,444	109,470	0	109,470
60-70	4,461	0	4,461	16,586	0	16,586
Totals	446,128	77,515	523,643	1,658,631	881,570	2,540,201

Table V-34. These costs and volumes are based on the timber characteristics and appraisal cost figures for the timbershed. The haul figures are based on the typical road configuration used at various distances from Eagar.

Based on these figures a supply schedule was constructed for ponderosa pine and mixed conifer. Tables V-35 and V-36 show the calculations for the ponderosa pine supply schedule and Figures V-9 and V-10 display these pine schedules graphically. Tables V-37 and V-38 and Figures V-11 and V-12 show calculations and schedules for the mixed conifers.

The supply schedules indicate that mixed conifer costs are somewhat less than ponderosa pine for volumes equal distances from the mill. These costs average almost $20/mbf more for ponderosa pine. The mixed conifer are generally closer to the mill than is the ponderosa pine. The mixed conifers are within a 30-mile distance whereas the ponderosa pine lies within a 60-mile distance. In this case mixed conifers are always cheaper than ponderosa pine, i.e., mixed conifer is $76/mbf at 30 miles whereas ponderosa pine is $85/mbf at 10 miles.

The volumes decrease rapidly after 30 miles distance from the mill. This creates a rapidly rising supply schedule indicating additional volumes can only be acquired at much higher costs. This situation is shown in the aggregate supply schedule calculations for the timbershed (Table V-38a, Figure V-13). In the aggregate case, the slope of the cost-by-distance (Figure V-14) schedule first rises at an increasing rate then rises at a constant rate after 40 miles distance. This is a function of the lower cost (less haul) ponderosa pine found at the greater distances. The lower cost (less haul) causes the slope to rise at a decreasing rate (compared to closer areas) even with longer hauls.

Table V-34. Typical Haul to Eagar Mill.

	Distance (Miles)						
	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Haul Dist. by road type							
Excellent (.39/mi)	3.35	10.05	16.75	23.45	30.15	36.85	43.55
Good (.51/mi)	.40	1.20	2.00	2.80	3.60	4.40	5.20
Fair (.55/mi)	.95	2.85	4.75	6.65	8.55	10.45	12.35
Poor (1.0/mi)	.30	.90	1.50	2.10	2.70	3.30	3.90
Average haul dist.	5.00	15.00	25.00	35.00	45.00	55.00	65.00
Variable round trip haul cost ($/mbf)	2.33	7.00	11.67	16.33	21.00	25.66	30.33
Fixed haul cost ($/mbf)	5.22	5.22	5.22	5.22	5.22	5.22	5.22
Total haul cost ($/mbf)	7.55	12.22	16.89	21.55	26.22	30.88	35.55

Road type

Excellent	67%
Good	8%
Fair	19%
Poor	6%

Table V-35. Ponderosa Pine Delivered Costs: Eagar Timbershed.

	Distance to the Mill (Miles)						
	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Fixed logging cost ($/mbf)	72.60	72.60	72.60	72.60	72.60	72.60	72.60
Haul cost ($/mbf)	7.55	12.22	16.89	21.55	26.22	30.88	35.55
Ave. total cost ($/mbf)	80.15	84.82	89.49	94.15	98.82	103.48	108.15
Total volume	149,277	474,368	427,927	298,554	182,449	109,470	16,586
Total cum. volume	149,277	623,645	1,051,572	1,350,126	1,532,575	1,642,045	1,658,631
Total cost	11,964,552	40,235,894	38,295,187	28,108,859	18,029,610	11,327,956	1,793,776
Total cum. cost	11,964,552	52,200,446	90,495,633	118,604,492	136,634,102	147,962,058	149,755,834
Ave. cost ($/mbf)	80.15	83.70	86.06	87.85	89.15	90.11	90.29

Table V-36. Eagar Timbershed Ponderosa Pine Supply Schedule Data.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	149,277	11,964,552			
10	(386,461)		40,235,894	474,368	84.82
10-20	623,645	52,200,446			
20	(837,609)		38,295,187	427,927	89.49
20-30	1,051,572	90,495,633			
30	(1,200,849)		28,108,859	298,554	94.15
30-40	1,350,126	118,604,492			
40	(1,441,351)		18,029,610	182,449	98.82
40-50	1,532,575	136,634,102			
50	(1,587,310)		11,327,956	109,470	103.48
50-60	1,642,045	147,962,058			
60	(1,650,338)		1,793,776	16,586	108.15
60-70	1,658,631	149,755,834			

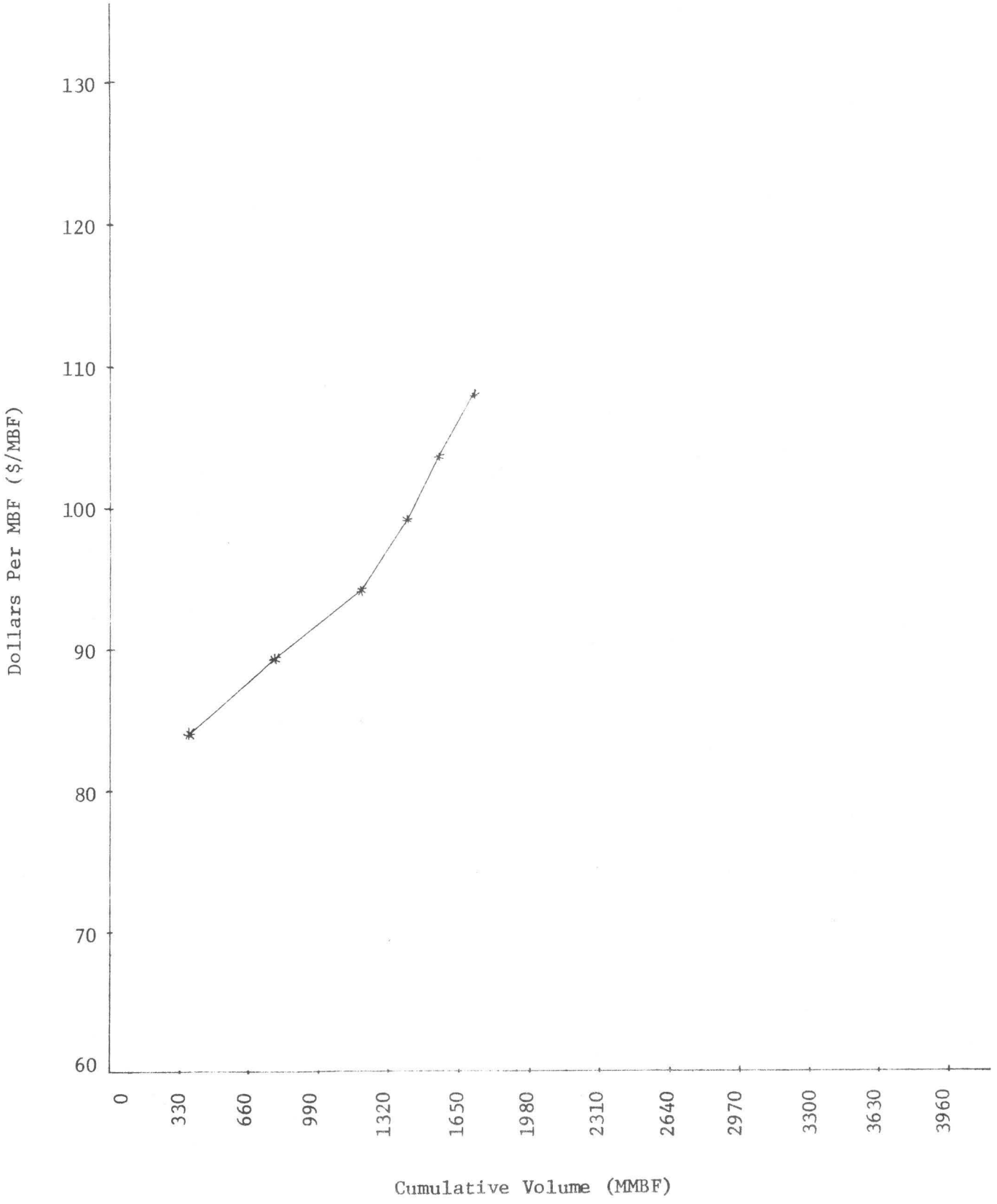

Figure V-9. Eagar Ponderosa Pine Supply Schedule by Volume.

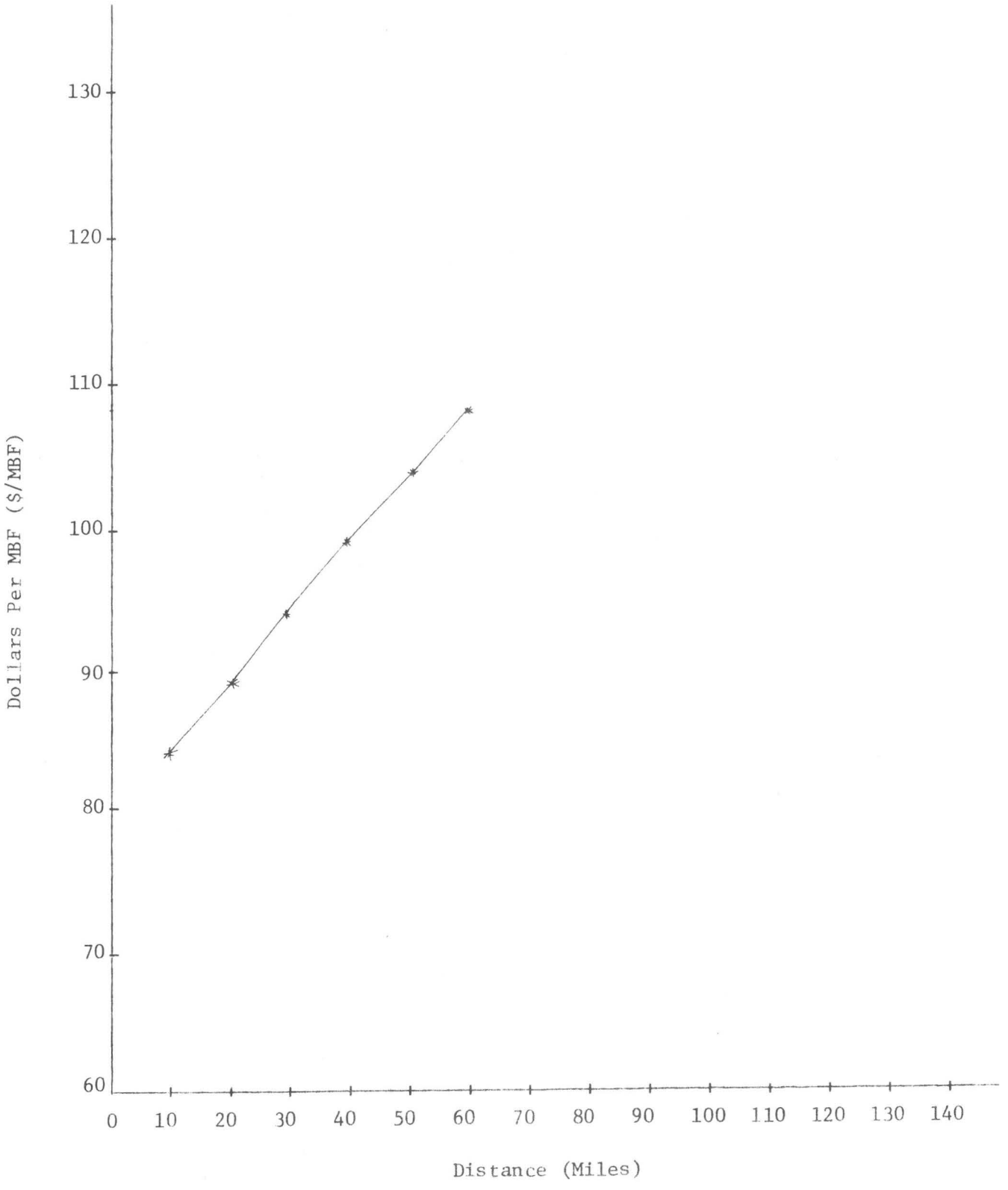

Figure V-10. Eagar Ponderosa Supply Schedule by Distance.

Table V-37. Mixed Conifer Delivered Costs: Eager Timbershed.

	Distance to the Mill (Miles)						
	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Fixed logging cost ($/mbf)	54.26	54.26	54.26	54.26	54.26	54.26	54.26
Haul cost ($/mbf)	7.55	12.22	16.89	21.55	26.22	30.88	35.55
Ave. total cost ($/mbf)	61.81	66.48	71.15	75.81	80.48	85.14	89.81
Total volume (mbf)	39,671	407,285	315,602	119,012	0	0	0
Total cum. volume (mbf)	39,671	446,956	762,558	881,570	881,570	881,570	881,570
Total cost ($)	2,452,065	27,076,307	22,455,082	9,022,300	0	0	0
Total cum. cost ($)	2,452,065	29,528,372	51,983,454	61,005,754	61,005,754	61,005,754	61,005,754
Ave. cost ($/mbf)	61.81	66.07	68.17	69.20	0	0	0

Table V-38. Eagar Timbershed MC Supply Schedule Data.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	39,671	2,452,065			
10	(243,314)		27,076,306	407,285	66.48
10-20	446,956	29,528,372			
20	(604,757)		22,455,083	315,602	71.15
20-30	762,558	51,983,454			
30	(822,064)		9,022,299	119,012	75.81
30-40	881,570	61,005,754			
40			0	0	0
40-50	881,570	61,005,754			
50			0	0	0
50-60	881,570	61,005,754	0	0	0
60					
60-70	881,570	61,005,754			

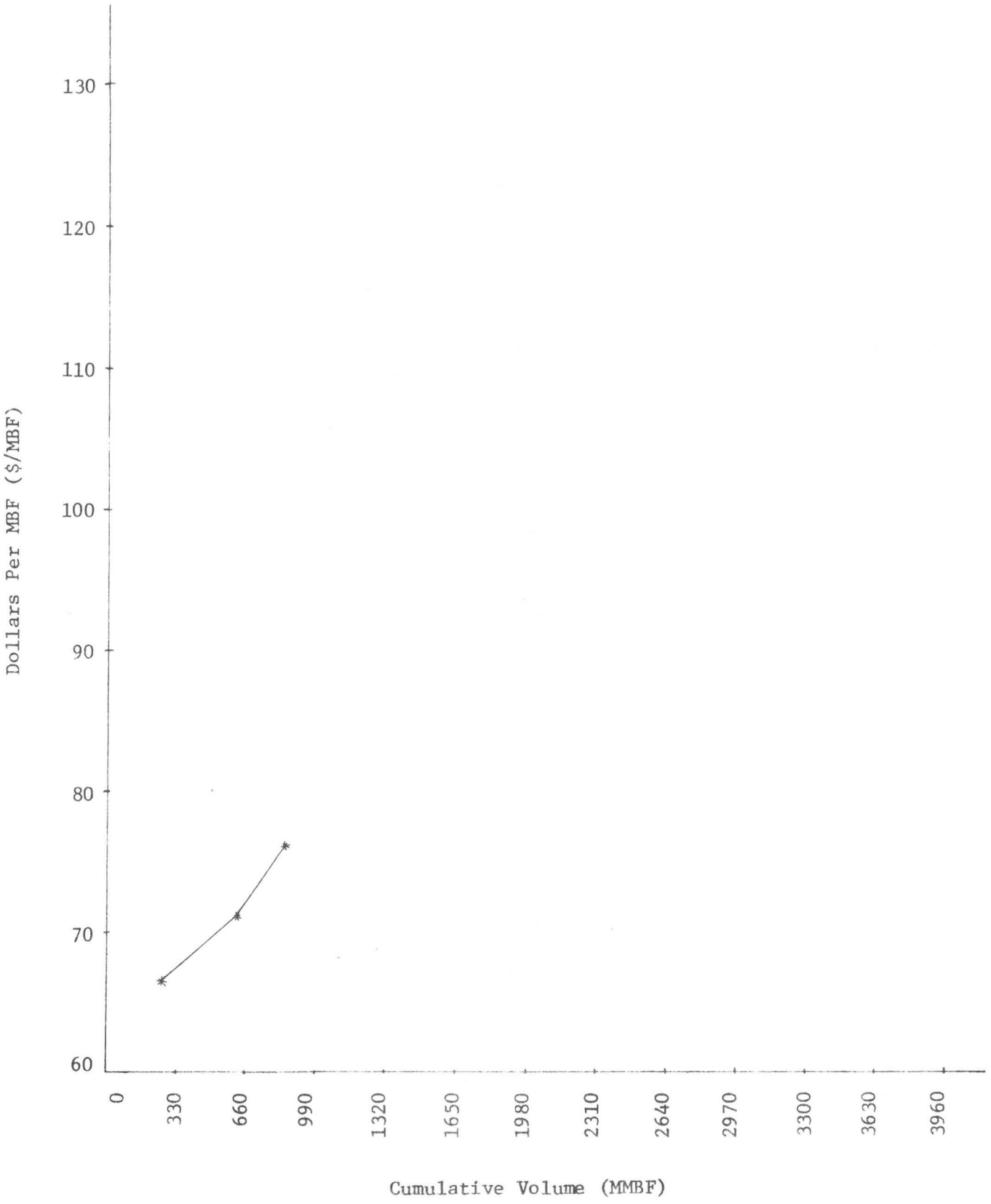

Figure V-11. Eagar Mixed Conifer Supply Schedule by Volume.

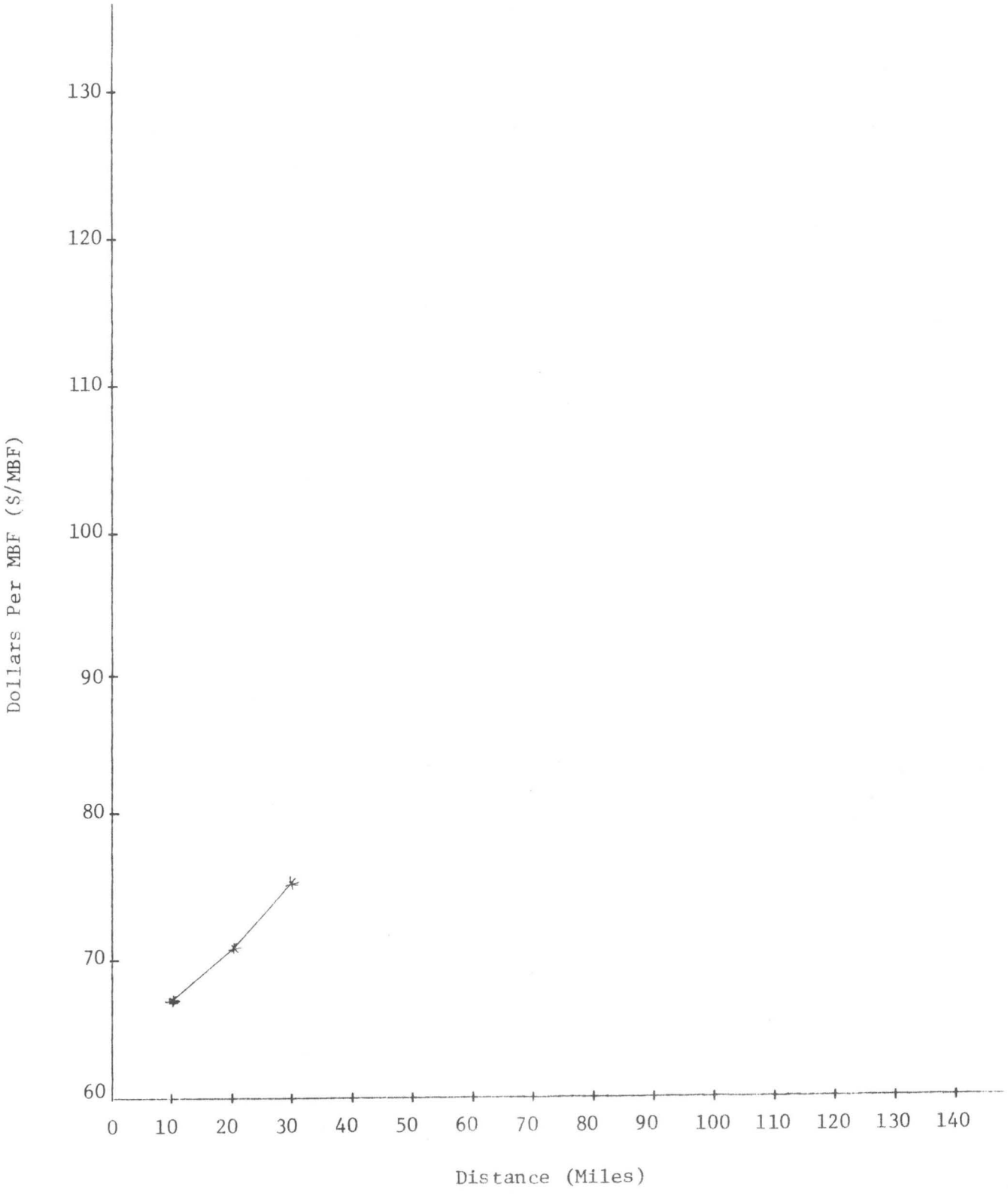

Figure V-12. Eagar Mixed Conifer Supply Schedule by Distance.

Table V-38a. Eager Aggregate Supply Schedule Data.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	188,948	14,416,617			
10	(629,775)		67,312,201	881,653	$ 76.35
10-20	1,070,601	81,728,818			
20	(1,442,366)		60,750,269	743,529	81.71
20-30	1,814,130	142,479,087			
30	(2,022,913)		37,131,159	417,566	88.92
30-40	2,231,696	179,610,246			
40	(2,322,921)		18,029,610	182,449	98.82
40-50	2,414,145	197,639,856			
50	(2,468,880)		11,327,956	109,470	103.48
50-60	2,523,615	208,976,812			
60	(2,531,908)		1,793,776	16,586	108.15
60-70	2,540,201	210,761,588			

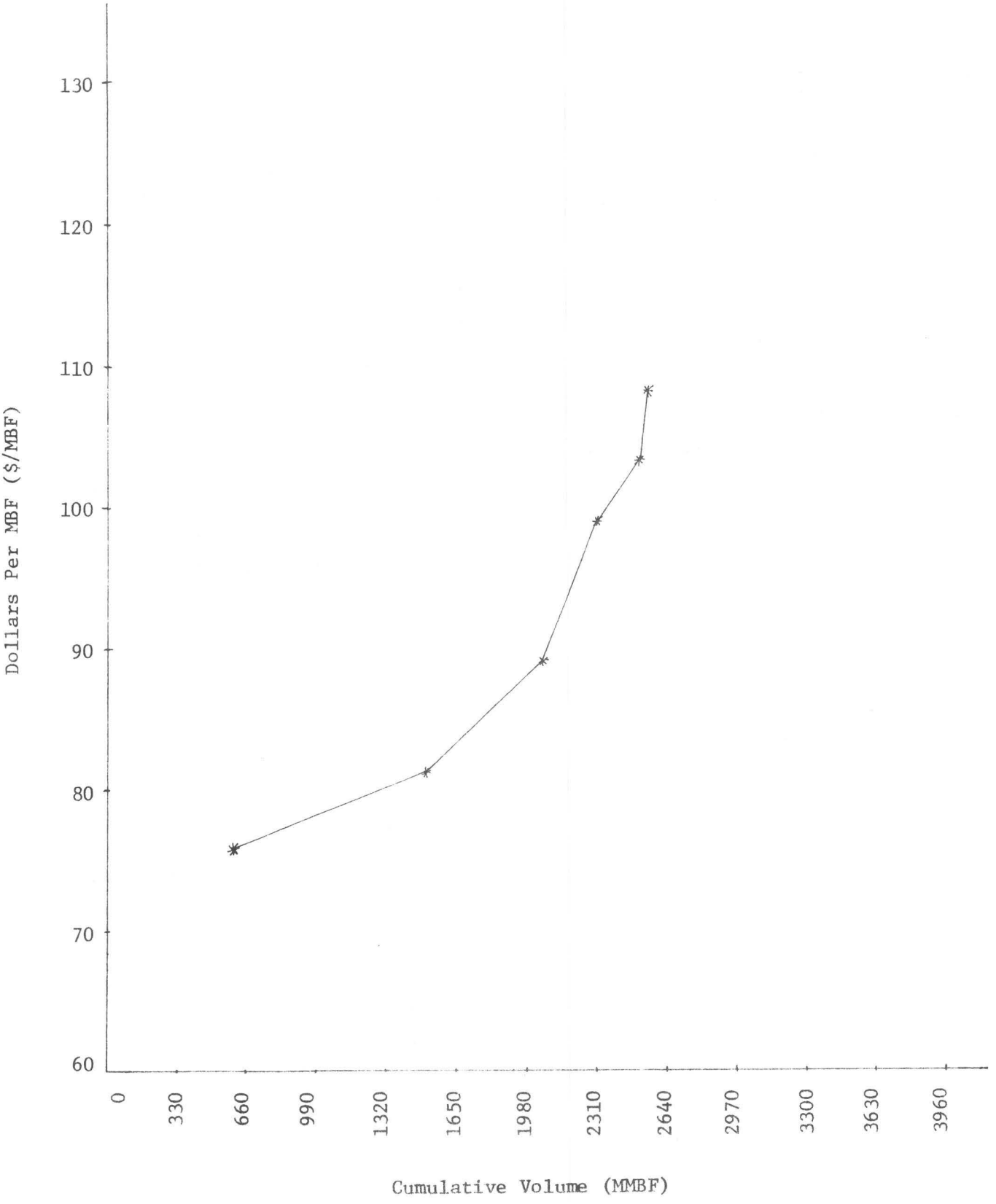

Figure V-13. Eagar Aggregate Supply Schedule by Volume.

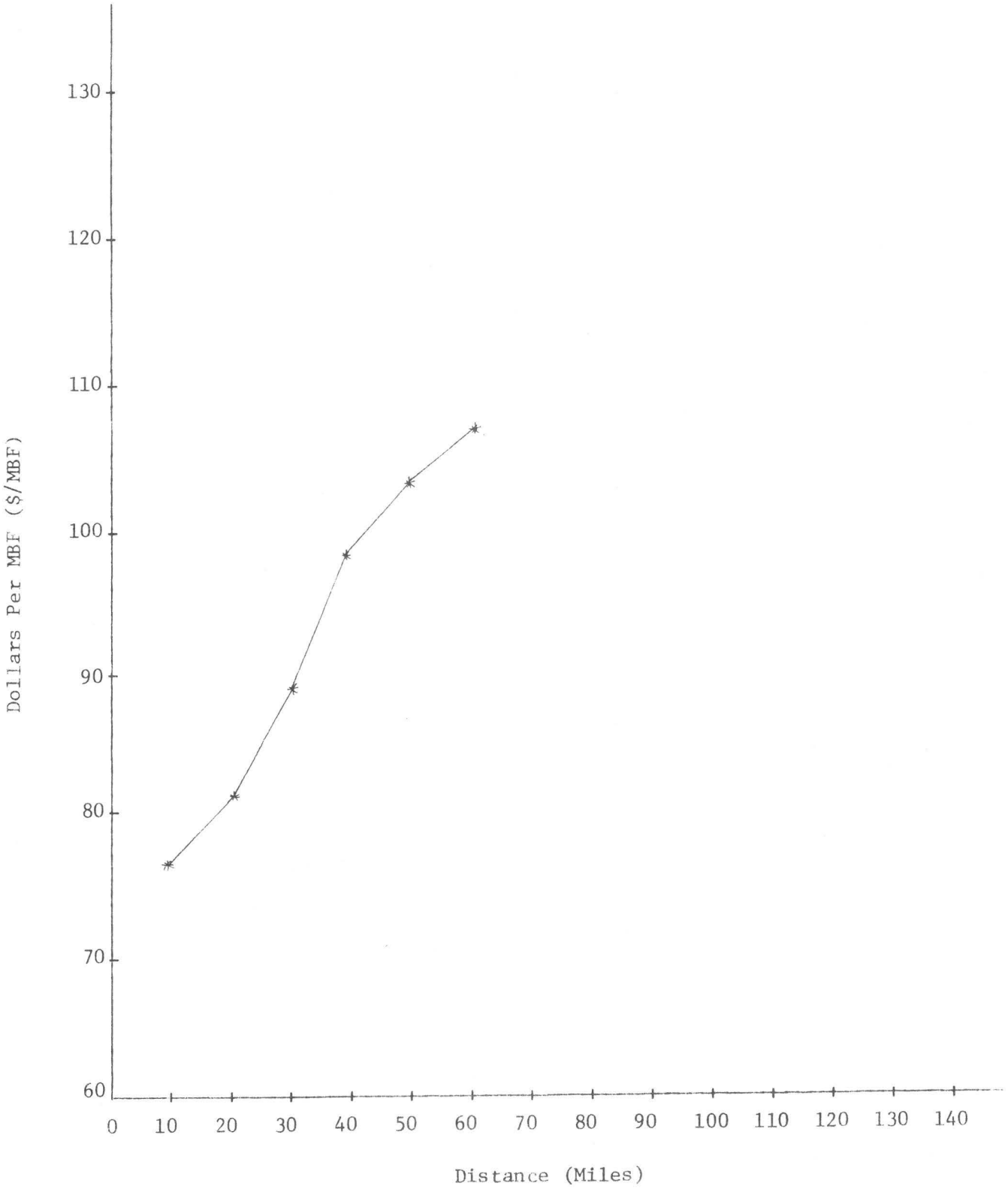

Figure V-14. Eagar Aggregate Supply Schedule by Distance.

8. Problems and Opportunities

Selling values of mixed conifer lumber and market uncertainty are the primary problems facing improved utilization of mixed conifers. The wood industry, in general, has always been plagued by fluctuations in the market. However, this present slump is coupled with rising operating and capital cuts. Together, they make the present situation very tenuous, particularly for lower-valued products.

As the market improves it might be possible to increase utilization by promoting the use of whole log chipping. This would use more of the raw material at the site and decrease the need to "yum" yard material. These "yum" materials might also be used to supply fuelwood to domestic users.

At the mill, careful grading, sorting, and sawing practices might help develop more upper grade material. This, understandably, is where the largest profit margin exists. There also seems to be an opportunity for a local post and pole operation. This might help the utilization of small material 9"-12" which the mill indicates results in lumber that has drying problems. This material contains a larger proportion of dense core causing the lumber to warp. To a certain extent this material could be used instead for barn poles or house logs. This diversification of products would also help to decrease reliance on the uncertain housing market.

The company feels the lower dbh limit (9") is not conducive to the dimension lumber market. Ordinarily, they feel a 12" dbh limit will yield 12% upper grades in the mixed conifer type; according to the mill the 9" limit produces hardly any "uppers."

As is the case in many areas, dimension material is most influenced by stumpage price and logging costs which together make up 50% of the total production cost. Ponderosa pine is the preferred species in that it produces far more upper grades (35-40%) and therefore commands a higher price. In the lower grades mixed conifer lumber brings a higher price but in the top "shop" grades ponderosa pine brings approximately $150/mbf more (i.e., #2 and better shop for finger joints, ponderosa pine sells at $800/mbf whereas mixed conifer sells at $650/mbf).

The company indicates that mixed conifer materials are most suitable for framing lumber, which is tied to the home construction industry. The product price, the company says, is influenced by products from British Columbia. Although the greatest utility for mixed conifers seems to be home building framing lumber there might be possibilities for certain specialty products. For example, Douglas-fir has been the preferred species for waterbed frames. This particular industry is expanding rapidly.

The recent addition of new mill capacity will make the sawmill considerably larger than the current programmed cut. This capacity (80 mmbf), however, is potential mill capacity and its actual one-shift capacity is probably about 40-50 mmbf. This would be close to the programmed cut/potential timber yield.

The close proximity of a pulpmill, as well as sawmill, makes this timbershed unique as compared to others in the two states. There is more opportunity here, compared to others, to develop an intensive timber management program. The pulpwood market creates the necessary outlet for smaller-sized material removed in thinning operations or left after logging.

c. Alamogordo, New Mexico

1. Timber Characteristics

The Alamogordo timbershed includes portions of the Mescalero Indian Reservation[2/] -- the Mayhill, Cloudcroft, and Sacramento districts of the Lincoln National Forest and state and private lands (Tables V-39 and V-40). Few adjustments were needed in determining acreage and volume figures presented in the tables. This is due to the fact that the timbershed boundaries correspond to those of the timbered area of the Mescalero reservation and the Sacramento Working Circle of the Lincoln National Forest (Figure V-15). The National Forest Districts not included in the timbershed are made up of timberland that is primarily marginal. Most of it is composed of understocked acreages of ponderosa pine or noncommercial forest land.

Commercial forest lands within the timbershed total 218,708 acres of National Forest land and 172,055 acres of Indian reservation land. Accessible, commercial National Forest lands within the timbershed total 183,000 acres. Areas considered inaccessible include 11,918 acres while noncommercial forest lands total 181,530 acres. A total of 53,360 acres of National Forest within the timbershed are nonforested (Table V-39).

Within the mixed conifer type, Douglas-fir is the most important commercial species. White fir is the fastest growing species in the type. Limited quantities of limber pine and ponderosa pine are also found in the mixed conifer type. Ponderosa pine is generally found on south- and west-facing slopes.

[2/] The timber management plan for the Mescalero Indian Reservation is now being developed and not currently available. The information cited in this section was gathered through a personal interview with BIA officials.

Table V-39. Land Use Classification, Alamogordo Timbershed.[1/]

Classification	Alamagordo Timbershed[1/]
Commercial Forest (NF)	218,708
Accessible	206,790
Inaccessible	11,918
Reserved	-
Noncommercial Forest (NF)	181,530
Nonforest Land (NF)	53,360
State and Private Land	99,122
Total within Forest Boundary	552,720

[1/] Includes Cloudcroft, Mayhill and Sacramento districts (pg. 6, Table D, TMP: 1970-1980 - Lincoln NF).

Table V-40. District and Ownership - Alamogordo Timbershed.

District	National Forest	State & Private	Total
Cloudcroft	192,816	29,731	222,547
Mayhill	108,233	31,028	139,261
Sacramento	152,549	38,363	190,912
Total	453,598	99,122	552,720

(Addendum, Table 44, TMP: 1970-80, Lincoln NF).

Figure V-15. Timbershed Characteristics, Alamogordo Processing Center.

Using the entire Lincoln National Forest as a proxy for the Alamogordo Timbershed, the TMP indicates that the majority of timber volumes occur in the oversize sawtimber size class (20"+) (Table V-41). (This is substantially larger than the diameters found in the appraisals (16"-18").) On an individual species basis, Table V-42 indicates that mixed conifer and its components, white fir, Douglas-fir, and aspen are the most prevalent species on the Forest. The Mescalero Reservation is about one-half pine and one-half mixed conifer. Interestingly the proportion of various sizes of timber is about the same for accessible and inaccessible lands (Table V-41). One might expect a larger proportion of large sawtimber on the inaccessible lands.

National Forest lands are divided into three working groups: the technical, administrative and marginal groups. The technical working group contains the major timber producing areas within the timbershed. Located in the Intermediate Zones of the Ruidoso[3/], Cloudcroft, Mayhill, and Sacramento districts, the technical working group includes 93,252 accessible softwood stocked acres which accounts for 28 percent of the commercial National Forest acres. The administrative working group includes the intermediate, travel influence, water influence, and special zones of the Ruidoso, Cloudcroft, Mayhill, and Sacramento districts. A total of 36,270 acres are included in the administrative working group which accounts for 13 percent of the Lincoln National Forest commercial forest land. The marginal working group includes the entire Smokey Bear and Guadalupe districts as well as isolated areas within the remaining

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[3/] Ruidosa district is not included in the timbershed. Data was not available for the Mayhill, Cloudcroft, and Sacramento districts individually.

Table V-41. Net Softwood Volumes by Accessibility and Size Class. Lincoln National Forest Lands Within Alamogordo Timbershed.

Accessible Lands (183,852 acres)

Size Class	Sawtimber[1/] MBF	Sawtimber[1/] MCF	Trees 5.0" DBH+ to 4.0" top dib
Seedlings/Saplings (0.0-4.9)	N/A	N/A	N/A
Small Poletimber (5.0-8.9)	N/A	N/A	19,684
Large Poletimber (9.0-10.9)	54,031	10,950	22,597
Small Sawtimber (11.0-15.9)	232,874	44,605	59,115
Large Sawtimber (16.0-19.9)	198,598	38,389	42,693
Oversize Sawtimber (20.0+)	511,118	92,831	97,212
	996,621	186,777	241,301
Inaccessible Lands (11,918 acres)			
Seedlings/Saplings	N/A	N/A	N/A
Small Poletimber	N/A	N/A	1,160
Large Poletimber	2,730	507	1,131
Small Sawtimber	15,534	3,013	4,184
Large Sawtimber	13,058	2,660	2,970
Oversize Sawtimber	28,443	5,419	5,690
	59,765	11,599	15,135

Source: Tables 20, 24, 28. Timber Management Plan, June 1970-July 1980, Lincoln N.F.

[1/] Trees 9.0" DBH and over, variable top limit of sawlog utilization.

Table V-42. Species Composition on Lincoln National Forest and Mescalero Indian Reservation.

Species	Lincoln		Mescalero
	Millions of Trees	Percent of Total	Percent only[1/]
White fir	825	27%	15.6%
Douglas fir	775	25%	31.1%
Aspen	640	21%	
Ponderosa pine	535	17%	49.0%
Limber pine	250	8%	
Corkbark fir	30	1%	
Englemann spruce	30	1%	
	3,085	100%	

Source: Lincoln N.F., TMP, July 1970-June 1980, Figure 1, pg. 6.

[1/] Also has 4.3% western white pine.

districts. Classification of areas in this working group is due primarily to steep slopes and, to a much lesser extent, heavy defect in old growth or nonstocked conditions. The BIA estimates about 5% of the mixed conifer on the reservation is on marginal lands. The USDA estimates about 60% of the Forest's marginal lands are occupied by the mixed conifer type.

Accessible forest lands within the timbershed contain four major forest types: ponderosa pine, mixed conifer, spruce-fir, and aspen. Mixed conifer on National Forest lands in the timbershed occupies a majority of the accessible lands (104,077 acres) with a total sawtimber volume of 789,150 mbf or 74% of the total sawtimber volumes present (Tables V-43 and V-44). The mixed conifers are primarily located in the central portion of the timbershed. This type typically has three times the volume per acre compared to ponderosa pine. The ponderosa pine type occupies 61,518 acres of National Forest lands within the timbershed. The remaining National Forest lands in the timbershed are occupied by the spruce-fir and aspen types which together contain approximately 14% of the sawtimber volumes present.

Again, using data from the entire Lincoln National Forest as a proxy for timber conditions within the timbershed, Table V-45 indicates that Site I and II lands account for a majority of the accessible lands. Mixed conifers make up the largest portion of the Site I lands (77%) and half of the Site II lands. The majority of the Site III land is ponderosa pine (86%). Therefore, from a site productivity standpoint the best opportunities to increase growth seem to lie in the mixed conifer type.

2. Silvicultural Prescriptions

A variety of silvicultural practices are utilized in the timbershed. The type of harvest and number of intermediate entries in a stand depend

Table V-43. Accessible Acres and Volumes, Lincoln National Forest Lands Within Alamogordo Timbershed.

Type	Acres	Volume[1/] (MBF)
Ponderosa pine	61,518	144,403
Mixed conifer	104,077	789,150
Spruce-fir[2/]	1,674	63,068
Aspen	8,014	84,778
	175,363	1,081,399

Source: Tables 46, 51, 52, 53, Timber Management Plan, July 1970-July 1980, Lincoln National Forest.

[1/] Trees 9.0" DBH and over; variable top limit sawlog utilization.

[2/] Includes softwood component within aspen type.

Table V-44. Volume per Acre and Percent of Volume, Lincoln National Forest.

Type	Trees 9.0" + DBH	Volume/Acre	Percent
Ponderosa pine	207,326 MBF	2,246	18.3%
Mixed conifer	835,168 MBF	7,539	73.7%
Spruce-fir	63,986 MBF	22,820	5.6%
Other[1/]	26,826	3,103	2.4%

Source: Page 32, Timber Management Planning, July 1970-July 1980, Lincoln National Forest.

[1/] Softwood component within Aspen type.

Table V-45. Acres and Volume by Accessibility, Site, Class, and Forest Type; Lincoln National Forest, Commercial Forest Acres.

Accessible	Acres	Percent of Total
Site I		
Ponderosa pine	11,323	14.9%
Mixed conifer	58,361	76.9%
Spruce-fir	1,869	2.5%
Aspen	4,322	5.7%
	75,875	100.0%
Site II		
Ponderosa pine	42,591	45.3%
Mixed conifer	46,072	49.1%
Spruce-fir	935	1.0%
Aspen	4,323	4.6%
	93,921	100.0%
Site III		
Ponderosa pine	38,380	85.8%
Mixed conifer	6,343	14.2%
Spruce-fir	-	-
Aspen	-	-
	44,723	100.0%

Source: Table F, page 8, Timber Management Plan, July 1970-July 1980, Lincoln National Forest.

upon the forest type and individual stand characteristics. Most of the timber harvest is now directed at removing 9"-12" dbh material to enhance understory release. The prescription for this release is best described as a group selection. In general, this results in less logging disturbance than individual tree selection. It also results in a mix of large and small material removed. Particular emphasis is given to removing mistletoe-infested trees or trees having poor form and/or defect. The mistletoe is quite widespread over the timbershed. However, there are no salvage cutting users per se. Infected trees are removed as part of the regular harvest.

Precommercial thinning is needed in cases of overstocking in stands < 20 years old. If funds were available USFS personnel indicate that the emphasis would be on timber stand improvement on the Site Class I and II lands. The thins would include developing a 15 x 15 spacing in younger stands and 20 x 20 in some older stands.

Natural regeneration is encouraged through the use of seed tree cuts in the ponderosa pine type and both seed tree and clearcuts in the mixed conifer type. Individual tree selection is used on special component lands. Slash disposal is necessary in most cases in order to reduce the risk of fire and/or to minimize the visual impact associated with logging.

On the Mescalero Reservation all material over 7' long is "yum" yarded. Estimates are that from 2 tons to 5 tons of residue are left per acre. According to BIA officials there has been some regeneration problems on the Indian reservation, due to past slash burning practices.

The Forest, in particular, wants to develop a silvicultural program that will favor Douglas-fir. To do so the cutting of white fir must be increased. The Forest feels that substantial acreage was overcut

when railroad logging was done years ago and that there will continue to be smaller-sized material available in the foreseeable future (this is contrary to what volume estimates show in the timber management plan (Table V-46) where large volumes of over-sized sawtimber are shown to exist).

3. Wood Procurement

The White Sands Mill in Alamogordo procures 45% of its timber from the Lincoln National Forest, 50% from the Mescalero Apache Reservation and 5% from private sources. There is also some timber procured from the Gila National Forest 230 miles from the mill. Understandably this is rather occasional as this Forest is some distance away. The White Sands Mill is the major buyer of timber in the area.

The Mill, U.S. Forest Service, and BIA personnel all feel that the procurement costs for mixed conifer and ponderosa pine are reasonably the same, with ponderosa pine being slightly more expensive because of more intensive slash disposal costs and somewhat longer hauls. The cost analysis (Table V-47) confirms these opinions as there were no statistically significant differences between the cost categories in mixed conifer and ponderosa pine sales. The sale acre sizes are reasonably the same although the sale volumes are normally much higher in mixed conifers.

Unlike some other areas mixed conifer selling values (log scale) were higher than ponderosa pine. This occurs even though there is significantly more defect in mixed conifer (27%) than in ponderosa pine (17%). However, the fact that the mixed conifer average dbh is somewhat larger (18" vs 16") could help to offset this defect problem. The fact that the selling values are higher and costs about the same makes mixed conifer total production costs less of a proportion of

Table V-46. Annual Net Growth and Volume, Alamogordo Timbershed.

Size Classes	Growth (MBF)[1/]		Volume (MBF)[2/]	
	Softwood	Aspen	Softwood	Aspen
Seedlings and saplings (0.0-4.9)	N/A	N/A	N/A	N/A
Small poletimber (5.0-8.9)	N/A	N/A	N/A	N/A
Large poletimber (9.0-10.9)	9,445	N/A	56,761	31,245
Small sawtimber (11.0-15.9)	8,283	3,382	248,408	31,964
Large sawtimber (16.0-19.9)	5,027	478	211,656	19,928
Oversized sawtimber (20.0+)	5,213	31	539,561	1,641
Total	27,968	3,891	1,056,386	84,778

[1/] Scribner rule.

[2/] DBH 9.0" and over.

(Addendum, Tables 20-31, TMP: 1970-1980, Lincoln NF)

Table V-47. Alamogordo Timbershed Summary Statistics Broken Down by Species.[1/]

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Differences Between Means[1/]
1. Acres					
Mixed conifer	Acres	936.0	117.0-1,758.0	689.4	Not tested
Ponderosa pine		1,060.0	434.0-1,786.0	681.5	
2. Sale volume					
Mixed conifer	Scribner MBF	4,914.7	176.0-12,750.0	4,800.9	Not tested
Ponderosa pine		1,912.7	378.0-4,900.0	2,587.4	
3. Average sale DBH					
Mixed conifer	Inches	18.18	14.3-21.3	2.43	No
Ponderosa pine		15.83	13.1-17.5	2.39	
4. Average sale defect					
Mixed conifer	Percent	27%	19.0-35.0%	5.81	Yes
Ponderosa pine		17.1	16.0-18.2	1.10	
5. Average Overrun					
Mixed conifer	Percent	29.0%	12.2-35.5%	8.84	Not tested
Ponderosa pine		35.3	28.2-40.3	6.30	
6. Hauling distance, sale-to-mill					
Mixed conifer	Miles	19.3	9.0-32.0	10.17	No
Ponderosa pine		23.3	13.0-31.0	9.29	
7. Hauling cost, sale-to-mill					
Mixed conifer	Cost per MBF	$19.45	$10.58-28.22	7.60	No
Ponderosa pine		15.69	10.55-24.21	7.43	

Table V-47 (con't).

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Differences Between Means[1/]
14. Specified road cost					
Mixed conifer	Cost per MBF	$21.50	$ 0.00-47.86	20.55	No
Ponderosa pine		1.81	0.00- 5.43	3.14	
15. Specified road requirements					
Mixed conifer	Miles	5.1	0.0 -10.2	4.34	Not tested
Ponderosa pine		.7	0 - 2.2	1.27	
16. Slash piling cost					
Mixed conifer	Cost per acre	$60.77	$37.05-89.16	20.28	Not tested
Ponderosa pine		48.04	10.42-87.69	38.68	
17. Slash lopping and scattering cost					
Mixed conifer	Cost per acre	$41.66	$ 8.57-111.73	48.60	Not tested
Ponderosa pine		6.98	3.76- 9.55	2.95	
18. Total slash disposal cost					
Mixed conifer	Cost per MBF	$25.78	$ 3.00-55.64	20.76	Not tested
Ponderosa pine		25.28	11.66-44.30	16.98	
19. Road maintenance cost					
Mixed conifer	Cost per MBF	$ 2.02	$ 0.00- 5.25	1.91	Not tested
Ponderosa pine		1.62	.56- 2.89	1.18	

Table V-47 (con't).

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Differences Between Means[1/]
8. Selling value, lumber tally					
Mixed conifer	$ per MBF	$201.02	$156.18-232.24	31.76	Not tested
Ponderosa pine		213.81	188.07-257.63	38.14	
9. Selling Value, log scale					
Mixed conifer	$ per MBF	$302.04	$261.79-333.38	27.82	No
Ponderosa pine		281.47	220.48-347.31	63.55	
10. Stump-to-truck logging cost					
Mixed conifer	Cost per MBF	$ 49.89	$ 36.93- 67.08	12.79	No
Ponderosa pine		43.10	39.91- 45.15	2.80	
11. Environmental protection cost					
Mixed conifer	Cost per MBF	$ 31.00	$ 4.94- 66.01	23.44	No
Ponderosa pine		39.82	34.62- 45.99	5.75	
12. Temporary road cost	Cost per MBF				
Mixed conifer		$ 7.75	$ 0.00- 29.79	11.50	No
Ponderosa pine		8.03	6.07- 11.08	2.69	
13. Temporary road requirements					
Mixed conifer	Miles	7.1	0.0 - 17.0	8.11	Not tested
Ponderosa pine		4.9	2.3 - 7.5	2.60	

Table V-47 (con't).

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Differences Between Means1/
20. General logging overhead					
Mixed conifer	Cost per MBF	$ 12.95	$ 9.92-15.54	2.37	No
Ponderosa pine		12.22	11.09-13.51	1.22	
21. Manufacturing cost					
Mixed conifer	Cost per MBF	$135.56	$101.59-164.03	26.38	No
Ponderosa pine		131.83	110.82-158.63	24.43	
22. Total production cost with road cost					
Mixed conifer	Cost per MBF	$267.17	$233.00-314.46	34.99	No
Ponderosa pine		241.87	207.77-263.69	29.92	
23. Total production cost without road cost					
Mixed conifer	Cost per MBF	$245.67	$217.68-267.35	22.38	No
Ponderosa pine		240.06	207.77-263.69	28.95	
24. Average advertised					
Mixed conifer	$ per MBF	$ 39.45	$ 23.12- 92.44	39.38	No
Ponderosa pine		50.17	23.71- 90.03	35.13	

Table V-47 (con't).

Variable and Species	Unit of Measure	Mean Value	Range	Deviation	Significant Differences Between Means[1/]
25. Average advertised rate divided by total production without road costs					
Mixed conifer	Percent	16.9%	N/A	17.3	No
Ponderosa pine		22.3	9.5 - 43.3%	18.4	
26. Average advertised rate divided by selling value, log scale					
Mixed conifer	Percent	12.5%	8.8 - 29.8%	13.1	No
Ponderosa pine		17.1	8.6 - 25.9%	8.7	
27. Total production cost without road cost divided by selling value, log scale					
Mixed conifer	Percent	81.8%	70.2-100.0%	10.1	No
Ponderosa pine		89.8	59.8-119.6	29.9	

[1/] Cable logging is done as part of conventional logging sales. Therefore it is impossible to separate costs.

selling value (82%) than ponderosa pine (90%) (Table V-47). This is a direct reversal of the situation faced by Arizona mills and could be the reason for this company's preference for mixed conifer stumpage.

The Alamogordo mill estimates that about 60% of their total production cost is incurred in getting raw material to the mill (stumpage plus logging and hauling). The cost figures are somewhat less (53%) but close to the mill's estimates (Table V-48). Of total production cost involved in getting logs to the mill, estimates indicate that 50% are stumpage fees and 50% are logging and hauling costs.

Cable logging is currently used in some cases on steeper slopes or marginal lands. Group selection is normally the prescription. The Lincoln National Forest hopes to have at least 2 mmbf of cable sales available annually. Generally, cable sales have been combined with conventional logging sales. However, there is some concern that locations suited to this mix of logging systems will be more difficult to find in the future. Unless this "mix" can be developed it is doubtful that a cable sale alone would be economical.

In the past, the mills have expressed concern regarding the costs of cable logging. They contend that it costs approximately $40/mbf more to log by cable than by conventional methods. They have indicated that $20 of this is due to the added defect in the older timber which is typical of the marginal lands. However, they do accept and plan to continue cable logging.

The BIA officials at the Mescalero Apache Reservation are less enthusiastic about cable logging. The do not favor skyline systems but would consider a modified type of "jammer logging" on steep slopes. According to BIA personnel the reservation has had a problem in the

Table V-48. Summary Statistics for Alamogordo Timbershed, All Sales Combined Regardless of Species.

Variable	Unit of Measure	Mean Value	Range	Standard Deviation
1. Acres	Acres	977.3	117.0-1,786.0	645.77
2. Sale volume	Scribner MBF	3,914.00	176.0-12,750.0	4,281.61
3. Average sale DBH	Inches	17.4	13.1-21.3	2.55
4. Average sale defect	Percent	23.7%	16.0-35.0%	6.79
5. Average Overrun	Percent	31.1%	12.2-40.3%	8.28
6. Hauling distance sale-to-mill	Miles	20.7	9.0-32.0	9.50
7. Selling value, lumber tally	$ per MBF	$205.87	$156.18-257.63	32.17
8. Selling value, log scale	$ per MBF	$295.18	$220.48-347.31	39.99
9. Stump-to-truck logging cost	Cost per MBF	$ 47.63	$ 36.93- 67.08	10.76
10. Environmental protection cost	Cost per MBF	$ 33.94	$ 4.94- 66.01	19.27
11. Temporary road costs	Cost per MBF	$ 7.84	$ 0.0 - 29.79	9.19
12. Temporary road requirements	Miles	6.26	0.0 - 17.0	6.39
13. Specified road cost	Cost per MBF	$ 14.74	$ 0.00- 47.86	19.06
14. Specified road requirements	Miles	3.64	0.0 - 10.2	4.12

Table V-48 (con't).

Variable	Unit of Measure	Mean Value	Range	Standard Deviation
15. Slash piling cost	Cost per acre	$ 56.53	$ 10.42-89.16	25.91
16. Slash lopping and scattering cost	Cost per acre	$ 26.80	$ 3.76-111.73	39.08
17. Total slash disposal costs	Cost per MBF	$ 25.62	$ 3.00-55.64	18.48
18. Road maintenance cost	Cost per MBF	$ 1.89	$ 0.00- 5.25	1.63
19. Hauling cost sale-to-mill	Cost per MBF	$ 18.20	$ 10.55-28.22	7.31
20. General logging overhead cost	Cost per MBF	$ 12.71	$ 9.92-15.54	2.00
21. Manufacturing cost	Cost per MBF	$134.41	$101.59-164.03	24.24
22. Total production costs with road costs	Cost per MBF	$241.87	$207.77-263.69	29.92
23. Total production costs without road costs	Cost per MBF	$240.06	$207.77-263.69	28.95
24. Average advertised rate	$ per MBF	$ 43.02	$-23.12- 92.44	36.15
25. Average advertised rate divided by total cost w/o road costs	Percent	22.3%	9.5 - 43.3%	18.4
26. Total production cost w/o road costs divided by selling value, log scale	Percent	89.8%	59.8 -119.6%	29.9

recent past regarding cuts on steep slopes resulting in high levels of erosion.

4. Actual Cut, Programmed Cut, and Potential Yield

The annual allowable harvest within the timbershed equals 5.6 million board feet on the Lincoln National Forest and approximately 18 million feet on the Mescalero Reservation lands (Tables V-49 and V-50). The potential yield exceeds mill capacity by a considerable amount. According to the TMP, on the Lincoln National Forest alone the potential biological yield amounts to 75.4 mmbf per year. This is considerably higher than what the Forest personnel currently feel is possible. The present feeling is that the potential yield is probably about half of this or 35 mmbf for the Lincoln.

Personnel on the Forest also feel that the programmed allowable cut should be reduced. They believe that cutting 15 mmbf (programmed cut) is substantially too high and that 7 mmbf is more reasonable. In 1981, they feel this amount (7 mmbf) will be difficult to find and prepare for sale. The BIA also feels the programmed cut of 18 mmbf for the Indian lands is too high and plans to reduce this level to 15 mmbf. This may create problems for the mill in that they already have capacity available in excess of the present actual cut, about 35% more.

There is no problem with selling timber put up for sale. All sales that have been prepared for sale have sold. The Forest staff feel the present planning effort should not significantly change this number and quantity of sales. Over the years, the average actual cut on the Lincoln has been somewhat less than the current programmed allowable cut. On the other hand, the average actual cut on Indian lands has been somewhat higher than the allowable cut until just recently (Tables V-51 and V-52).

Table V-49. Alamogordo Processing Center.

Potential Yield		
Lincoln National Forest Lands	75	MMBF/year
Mescalero Indian Reservation		N/A
Allowable Cut		
Lincoln National Forest	15.6	MMBF/year
Mescalero Indian Reservation	18.1	MMBF/year
Actual Cut (Avg., last ten years)[1/]	26	MMBF/year
Mill Capacity	35	MMBF/year

[1/] Mescalero and Lincoln.

Table V-50. Annual Allowable Sawtimber Cut - Alamogordo Timbershed.[1/]

District	Working Group	Sawtimber MBF
Cloudcroft	Tech. - Adm. - Marg.	8,000
Mayhill	Tech. - Adm. - Marg.	3,200
Sacramento	Tech. - Adm. - Marg.	4,400
Total Allowable Sawtimber Cut		15,600

(pg. 46, TMP: 1970-80, Lincoln N.F.)

[1/] Includes Cloudcroft, Mayhill, Sacramento districts, Lincoln N.F. Does not include state and private lands or Mescalero Indian Reservation.

Table V-51. Potential Yield, Lincoln National Forest Lands Within Alamogordo Timbershed.[1/]

Management Component	Sawtimber		Products	
	Cunits/A	MBF/A	Cunits/A	MBF/A
Standard	5.15	2.75	1.53	2.01
Special	5.18	2.76	.76	.97
Marginal	1.06	.56	.15	.19

[1/] Includes Mayhill, Cloudcorft, and Sacramento Districts, Lincoln National Forest. Timber Management Plan, Lincoln N.F., July 1970 to June 1980, Page 1. Based on total potential yield figures divided by total acreage figures for entire Lincoln N.F.

Table V-52. Actual Timber Harvest, 1962 to 1969, Lincoln National Forest, Mescalero Apache Reservation.

Fiscal Year	USFS Acres Cut	USFS Volume Cut (MBF)	USFS Volume/Acre (MBF)	Mescalero Apache
1962	3,700	2,279	.6	N/A
1963	3,604	7,477	2.1	N/A
1964	3,636	11,956	3.3	N/A
1965	4,630	13,923	3.0	N/A
1966	8,011	12,882	1.6	N/A
1967	4,184	12,848	3.1	N/A
1968	2,884	8,610	3.0	N/A
1969	5,773	18,583	3.2	N/A
1971	N/A	8,525	N/A	30,731
1972	N/A	9,488	N/A	37,163
1973	N/A	13,801	N/A	27,939
1974	N/A	10,693	N/A	23,056
1975	N/A	8,764	N/A	15,056
1976	N/A	14,884	N/A	17,646
1977	N/A	11,612	N/A	13,987
1978	N/A	10,728	N/A	15,044
1979	N/A	12,432	N/A	-
1980	N/A	7,688	N/A	4,116

Source: Page 26, Timber Management Plan, July 1970-June 1980, BIA Lincoln National Forest, and consultations with Forest Personnel.

5. Fuelwood Use

The fuelwood market currently represents the only market for small-sized material. There are both commercial and smaller individual use sales. Commercial operators are charged $15 per cord and individuals $5/cord by U.S. Forest Service. The Mescalero Indian Reservation charges $5/cord for commercial operators. There has been considerable increase in fuelwood harvests over the past 9 years (Table V-53).

About 60% of the use is from individuals residing in west Texas. Since about 1976, the Forest has developed a charge system for fuelwood use. Now about 80% of the fuelwood cut is cut by individuals who have purchased a $5/cord permit. Only about 8% of the total fuelwood cut is cut by large scale commercial operators. These operators sell primarily in west Texas. Currently, fuelwood sells for approximately $75/cord in Alamogordo.

The Mescalero Apache Reservation is planning to place more emphasis on fuelwood sales. Currently they sell only to commercial operators. Free use is available to Indians only. They are trying to develop sales on cut-over areas but are having some difficulty in getting bidders. Individual fuelwood sales are discouraged because of difficulties in sale administration.

6. Mill and Wood Product Markets

The Alamogordo Timbershed serves as the main source of raw material for the White Sands Forest Products' mill located in Alamogordo, New Mexico. There are 3 other small mills in the area each producing .5 to 1 mmbf annually. The White Sands mill has an estimated annual production of 20 mmbf with an eight-hour shift capacity of 100 mbf. Ponderosa pine, Douglas-fir, and white fir are the primary species utilized

Table V-53. Fuelwood Cut, Commercial and Individual.

	USFS Cords	Mescalero Apache Cords
1971	3,000	869
1972	2,850	986
1973	4,100	228
1974	10,700	1,880
1975	9,050	1,368
1976	15,600	1,351
1977	9,550	1,227
1978	11,050	1,723
1979	16,650	2,136
1980	14,950	2,378

by the mill. Facilities located at the mill include a debarker, band saw, skragg saw, gang saw, edger, chipper, and planer. Products produced include fencing, pallets, pulpwood, chips, and studs. Studs make up 90% of the production. They consider all products other than studs, "by-products." The mill feels studs are their most profitable product line and the rest of the products are marginal from a profit standpoint. The company sends chips to Snowflake and shavings to a particleboard plant in Albuquerque. Sawdust is disposed of in a teepee burner.

The studs are marketed primarily by wholesalers (75%) with retailers (15%) and manufacturers (10%) making up the remainder of the distribution system. About 90% of the production is marketed in New Mexico, Arizona, Texas and Oklahoma. The rest is marketed in California (2%), the Midwest (5%) or exported to Mexico (3%). There may be some possibility to expand the market in Mexico but the South Central area of the United States will probably remain the major market area. All lumber is shipped by truck.

Unlike some other mills in Arizona and New Mexico, White Sands prefers Douglas-fir and white fir rather than the ponderosa pine. They contend it allows them to make better quality studs that are more readily accepted in the market. All the lumber is air-dried to a moisture content of between 10 and 15%. There is no particular problem with air-drying as long as it's not kept too long and over-dried.

As the largest mill in the southeast corner of the Southwest area, White Sands has a fairly unique opportunity for certain local markets. This rather isolated position makes it difficult to send its by-products, like chips and shavings, to pulpmills or particleboard plants. But it does provide transportation advantages for shipping lumber to west Texas cities.

The timbershed would definitely benefit from a mill that was especially designed to handle small-sized material. The Indian reservation is contemplating starting such a mill. They believe a market could be developed if they had the small sawmill in operation.

There is expected to be a major decrease in timber volumes available from both Indian lands and the Lincoln National Forest, in particular from the Lincoln. This may create additional hardships in procuring the quantity and quality of timber necessary to sustain the stud mill. Perhaps additional timber can be procured from private lands or from the Gila National Forest, although this is unlikely. The mill capability of handling smaller-sized material is important to this timbershed.

All circumstances seem to point to a reduction in wood product production unless smaller-sized material can be utilized. As in other areas this means that special cooperation dealing with sale preparation and mill investment is necessary. If the market situation changes it may become economical to send more chips and possibly pulpwood to Snowflake. The existing market for aspen used to manufacture excelsior may also be expanded.

7. Supply Schedules

The area surrounding Alamogordo was sectioned into 10-mile intervals from the mill base. The number of acres of ponderosa pine and mixed conifers within each mileage zone was then estimated using a planimeter. Table V-54 shows the acreage and volume estimates. The volume estimates were derived by multiplying the acres by volume per acre figures, 2.35 mbf/acre for ponderosa pine and 7.58 mbf/acre for mixed conifers. These were U.S. Forest Service estimates and were also applied to Indian lands.

Table V-54. Alamogordo Timbershed Acreage and Volume Estimates.

Distance to Mill	Ponderosa	MC	Total
USFS Lands Only	- - - - - - - - - Acres - - - - - - - - -		
0-10	14,088	1,353	15,441
10-20	10,458	79,723	90,181
20-30	21,531	23,001	44,532
30-40	15,441	0	15,441
	61,518	104,077	165,595
	- - - - - - - Volume (mbf) - - - - - - - -		
0-10	33,068	10,259	43,327
10-20	24,549	604,489	629,038
20-30	50,541	174,402	224,943
30-40	36,245	0	36,245
	144,403	789,150	933,553
Mescalero Lands	- - - - - - - - - Acres - - - - - - - - -		
0-10	0	0	0
10-20	12,599	3,485	16,084
20-30	59,260	5,038	64,298
30-40	74,192	7,994	82,186
40-50	9,488	0	9,488
	155,539	16,517	172,056

Table V-54 (con't)

Distance to Mill	Ponderosa	MC	Total
	- - Volume (mbf, based on ave.'s for USFS land) - -		
Mescalero (con't)			
0-10	0	0	0
10-20	29,608	26,416	56,024
20-30	139,261	38,188	177,449
30-40	174,351	60,595	234,946
40-50	22,297	0	22,297
	365,517	125,199	490,716
Combined for Timbershed	- - - - - - - - Acres - - - - - - - - - - -		
0-10	14,088	1,353	15,441
10-20	23,057	83,208	106,265
20-30	80,791	28,039	108,830
30-40	89,633	7,994	97,627
40-50	9,488	0	9,488
	217,057	120,594	337,651
	- - - - - - - - - - Volume (mbf) - - - - - - - - - -		
0-10	33,068	10,259	43,327
10-20	54,157	630,905	685,062
20-30	189,802	212,590	402,392
30-40	210,596	60,595	271,191
40-50	22,297	0	22,297
	409,920	914,349	1,424,269

The variable haul costs for each zone were estimated based on the road system most commonly utilized to gain access to timber in that zone. Table V-55 shows the haul figures per mbf for each zone. Given these variable haul cost estimates and the logging costs for mixed conifer and ponderosa pine a total average cost was derived for each zone (Tables V-56, V-57, V-58, V-59). These costs, coupled with volume data, were used to determine a cost per mbf for mixed conifer and ponderosa pine logs delivered to Alamogordo. A combined cost schedule for both was also estimated (Tables V-60, V-61). The data in these tables were used to construct graphs of supply schedules.

Figures V-16 and V-17 display the supply schedule for ponderosa pine. In this case the rate of increase in costs per mbf declines over the mid-range of cumulative volume in the supply schedule. This is because the bulk of the pine lies within 20 to 30 miles of the processing center. In mixed conifers (Figures V-18 and V-19) the majority of the volume is within the 10-20 mile range creating a dramatic increase in cost/mbf for additional volumes beyond that distance. The combination of the two species generates a "classic" aggregate supply schedule (Figures V-20 and V-21).

In general there is considerably more mixed conifer volume available closer to the mill. The procurement costs of mixed conifer is therefore lower and more volume can be procured at less of a cost. For example, approximately 500 mmbf of mixed conifer can be procured at a cost of $100/mbf or less where 500 mmbf of ponderosa pine would require a cost of $109/mbf or less, about 10% more. The majority of the pine is on the Indian reservation, and most of the mixed conifer is on the Lincoln National Forest.

Table V-55. Alamogordo Haul Costs.

Road Type	Mill Distance				
	0.10	10-20	20-30	30-40	40-50
Excellent (.39/mi)	4.10	12.30	20.50	28.70	36.90
Good (.51/mi)	0.20	0.60	1.00	1.40	1.80
Fair (.55/mi)	0.05	0.15	0.25	0.35	0.45
Poor (1.00/mi)	0.65	1.95	3.25	4.55	5.85
	5.00	15.00	25.00	35.00	45.00
Total variable haul cost/mbf	2.38	7.14	11.89	16.65	21.41
Total fixed haul cost/mbf	5.22	5.22	5.22	5.22	5.22
	7.60	12.36	17.11	21.87	26.63

Table V-56. Delivered Costs: Ponderosa Pine, Alamogordo Timbershed.

	Distance to the Mill (miles)				
	0-10	10-20	20-30	30-40	40-50
Fixed logging cost ($/mbf)	92.54	92.54	92.54	92.54	92.54
Haul cost ($/mbf)	7.60	12.36	17.11	21.87	26.63
Avg. total cost ($/mbf)	100.14	104.90	109.65	114.41	119.17
Total volume	33,068	54,157	189,802	210,596	22,297
Total cum. volume	33,068	87,225	277,027	487,623	509,920
Total cost	3,311,430	5,681,069	20,811,789	24,094,288	2,657,133
Total cum. cost	3,311,430	8,992,499	29,804,288	53,898,576	56,555,710
Avg. cost ($/mbf)	100.14	103.10	107.59	110.53	110.91

Table V-57. Supply Schedule Data, Ponderosa Pine.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	33,068 (60,147)	3,311,430	5,681,069	54,157	$104.90
10-20	87,225 (182,126)	8,992,499	20,811,789	189,802	109.65
20-30	277,027 (382,325)	29,804,288	24,094,288	210,596	114.41
30-40	487,623 (498,772)	53,898,576	2,657,133	22,297	119.17
40-50	509,920	56,555,710			

Table V-58. Delivered Costs: Mixed Conifer, Alamogordo Timbershed.

	Distance to the Mill (Miles)			
	0-10	10-20	20-30	30-40
Fixed logging cost ($/mbf)	90.66	90.66	90.66	90.66
Haul cost ($/mbf)	7.60	12.36	17.11	21.87
Avg. total cost ($/mbf)	98.26	103.02	107.77	112.53
Total volume	10,259	630,905	212,590	60,595
Total cum. volume	10,259	641,164	853,754	914,349
Total cost	1,008,049	64,995,833	22,910,824	6,818,755
Total cum. cost	1,008,049	66,003,882	88,914,707	95,733,462
Avg. cost ($/mbf)	98.26	102.94	104.15	104.70

Table V-59. Supply Schedule Data, Mixed Conifer.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	10,259	1,008,049			
	(325,712)		64,995,833	630,905	103.02
0-20	641,164	66,003,882			
	(747,459)		22,910,824	212,590	107.77
20-30	853,754	88,914,707			
	(884,052)		6,818,755	60,595	112.53
30-40	914,349	95,733,462			

Table V-60. Delivered Costs: Aggregate, Alamogordo Timbershed.

	Distance to the Mill (Miles)				
	0-10	10-20	20-30	30-40	40-50
Total volume	43,327	685,062	402,392	271,191	22,297
Total cum. volume	43,327	728,389	1,130,781	1,401,972	1,424,269
Total cost	4,319,479	70,676,903	43,722,614	30,913,043	2,657,133
Total cum. cost	4,319,479	74,996,382	118,718,996	149,632,039	152,289,172
Avg. cost ($/mbf)	99.69	102.96	104.99	106.73	106.92

Table V-61. Supply Schedule Data, Aggregate.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	43,327	4,319,479			
	(385,858)		70,676,903	685,062	103.17
10-20	728,389	74,996,382			
	(929,585)		43,722,614	402,392	108.66
20-30	1,130,781	118,718,996			
	(1,266,377)		30,913,043	271,191	113.99
30-40	1,401,972	149,632,039			
	(1,413,121)		2,657,133	22,297	119.17
40-50	1,424,269	152,289,172			

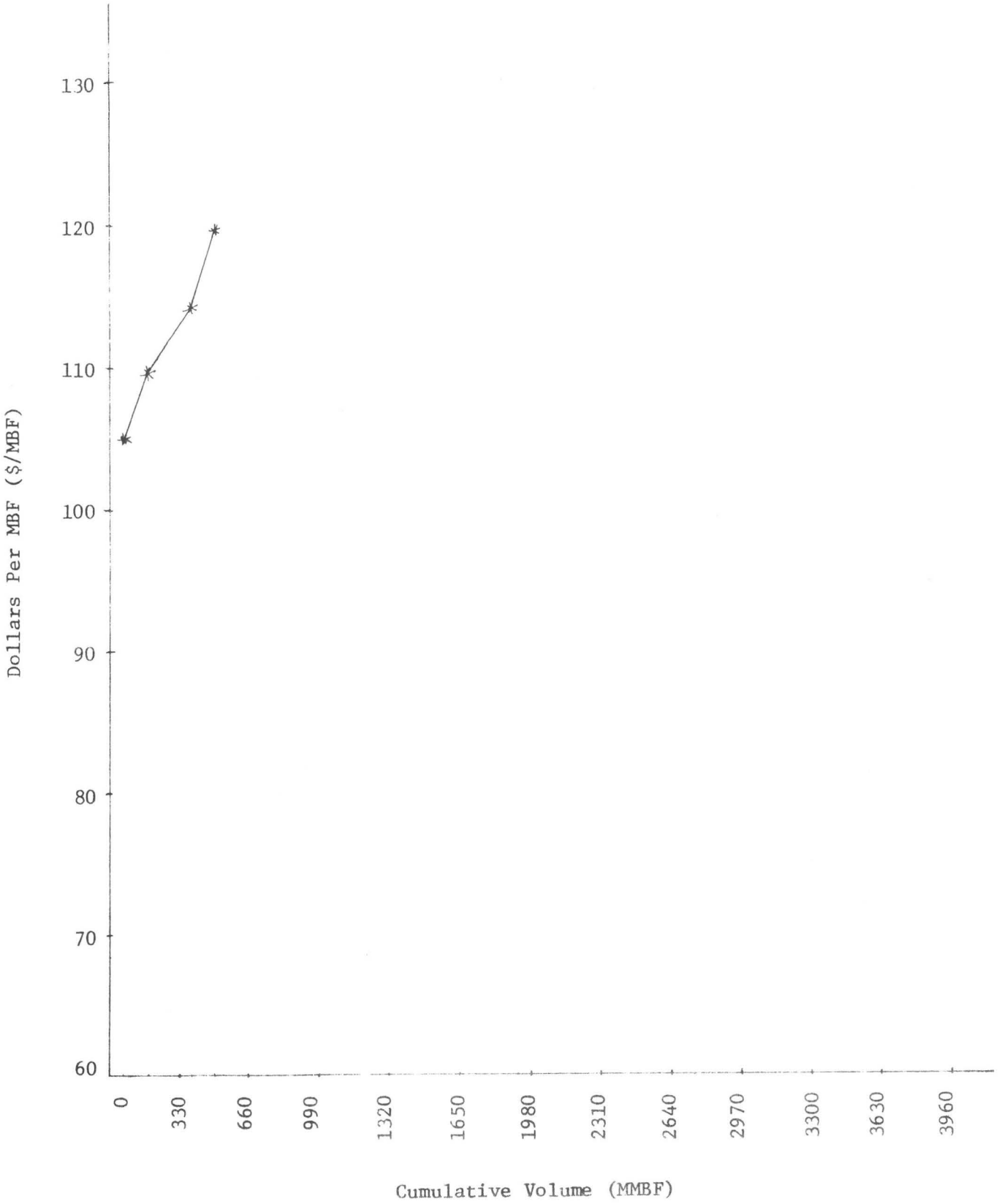

Figure V-16. Alamogordo Ponderosa Pine Supply Schedule by Volume.

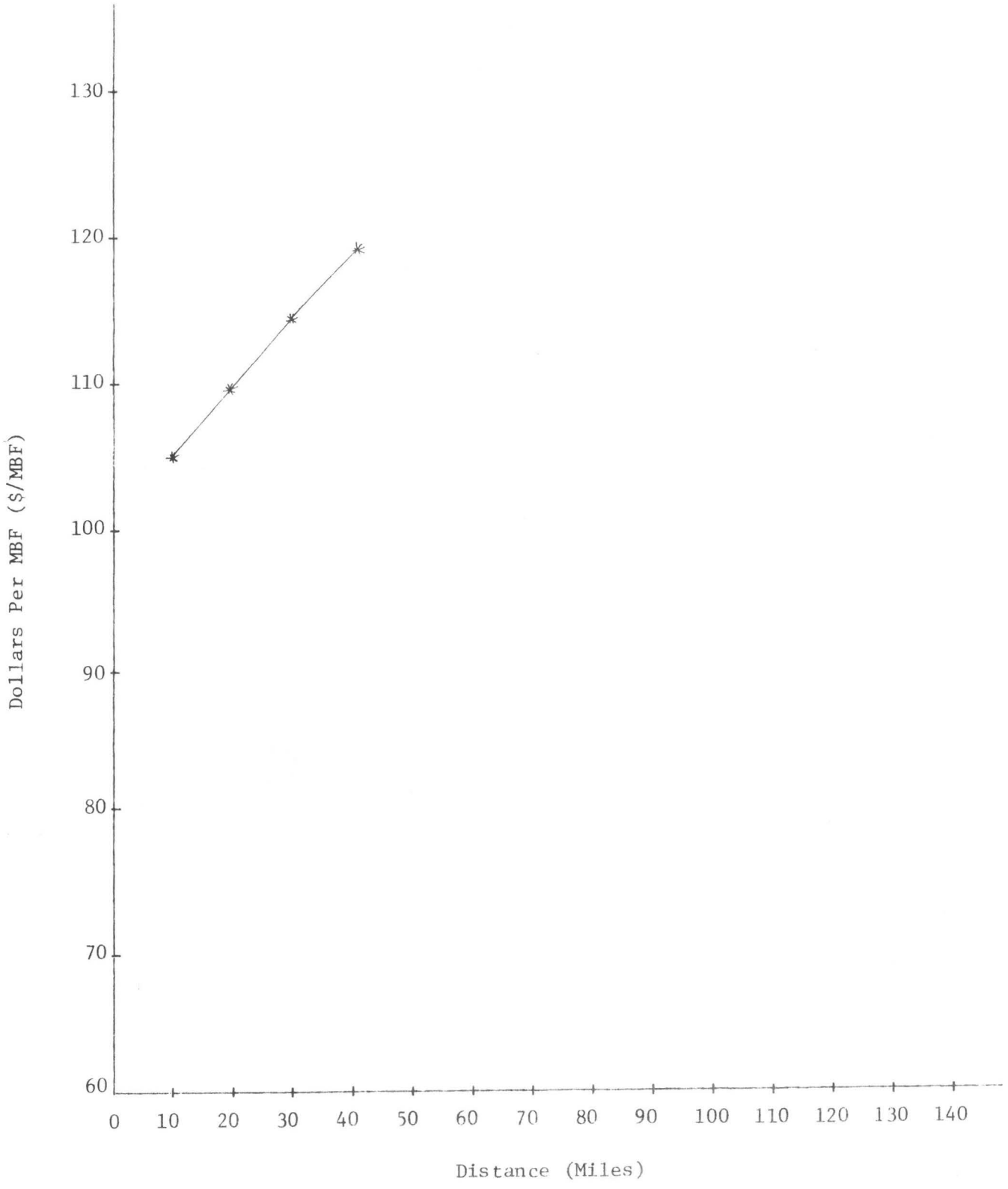

Figure V-17. Alamogordo Ponderosa Pine Supply Schedule by Distance.

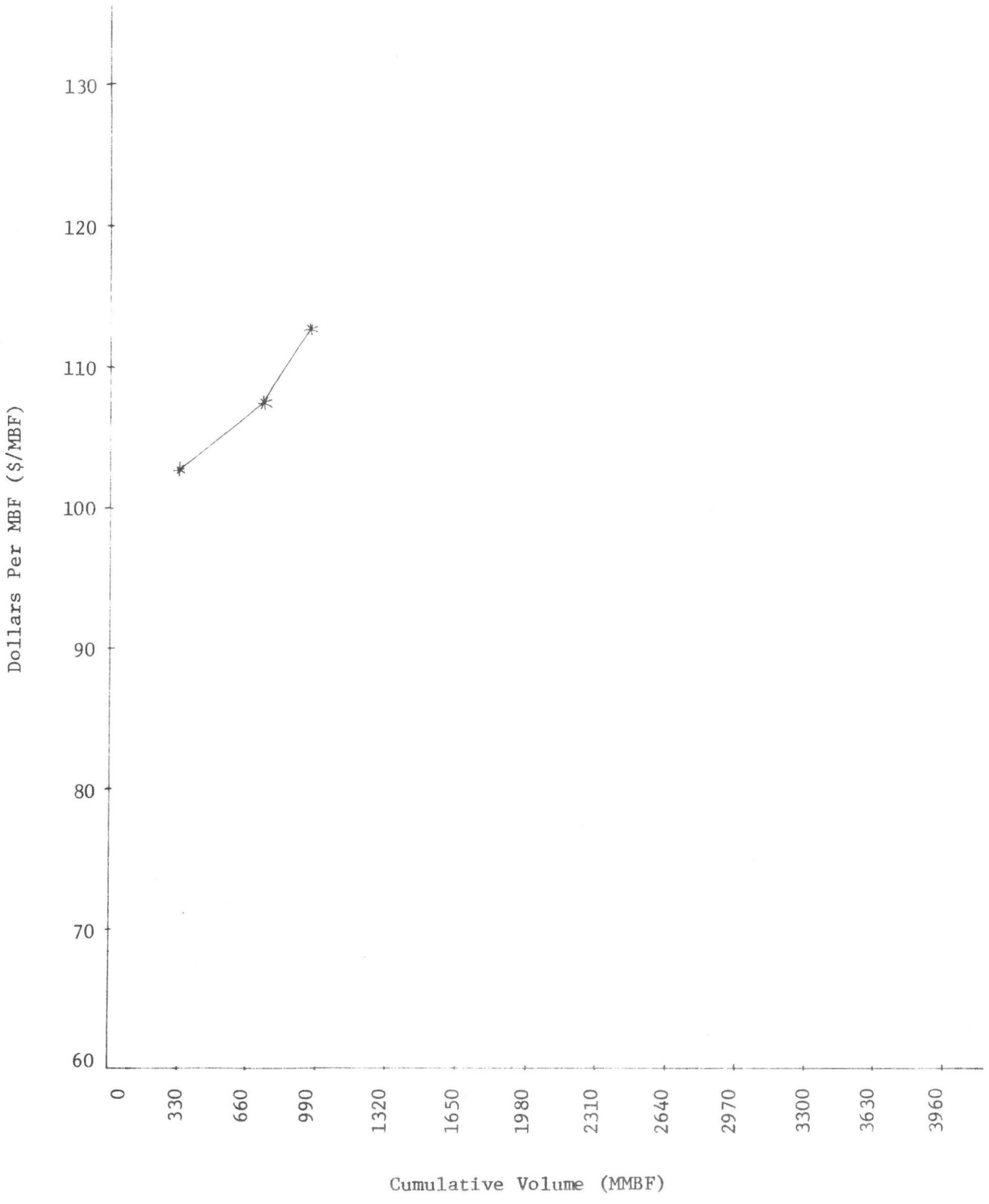

Figure V-18. Alamogordo Mixed Conifer Supply Schedule by Volume.

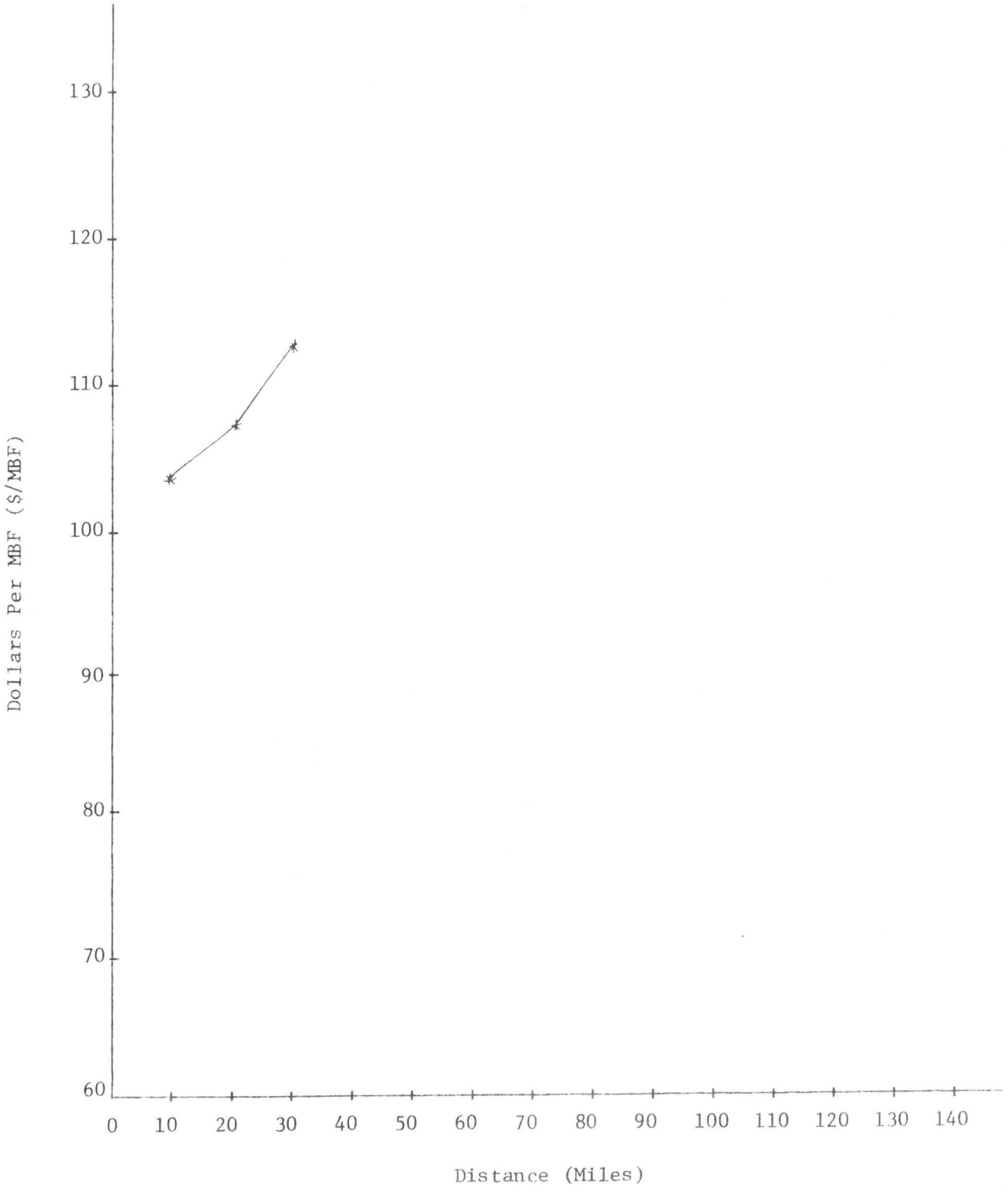

Figure V-19. Alamogordo Mixed Conifer Supply Schedule by Distance.

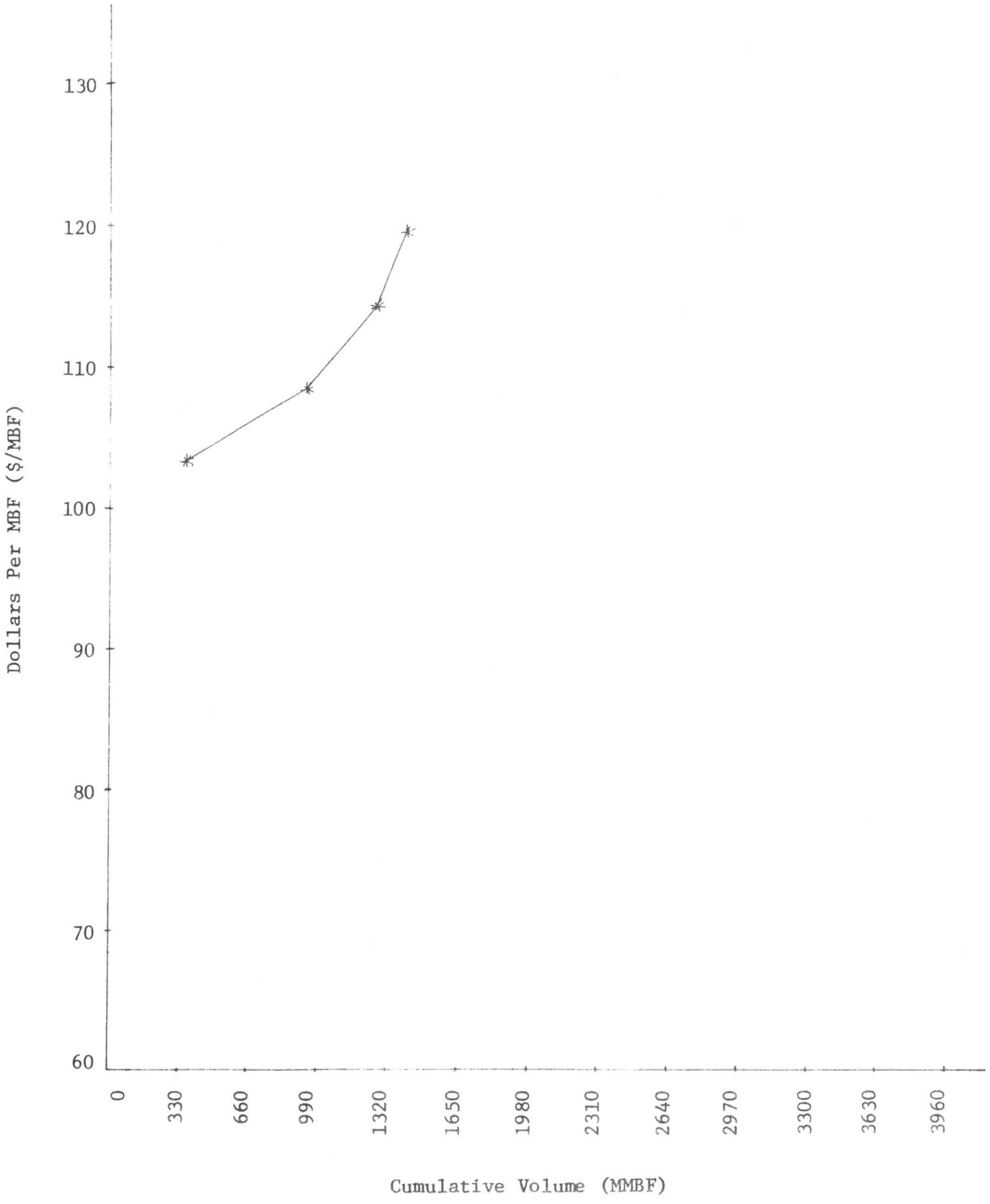

Figure V-20. Alamogordo Aggregate Supply Schedule by Volume.

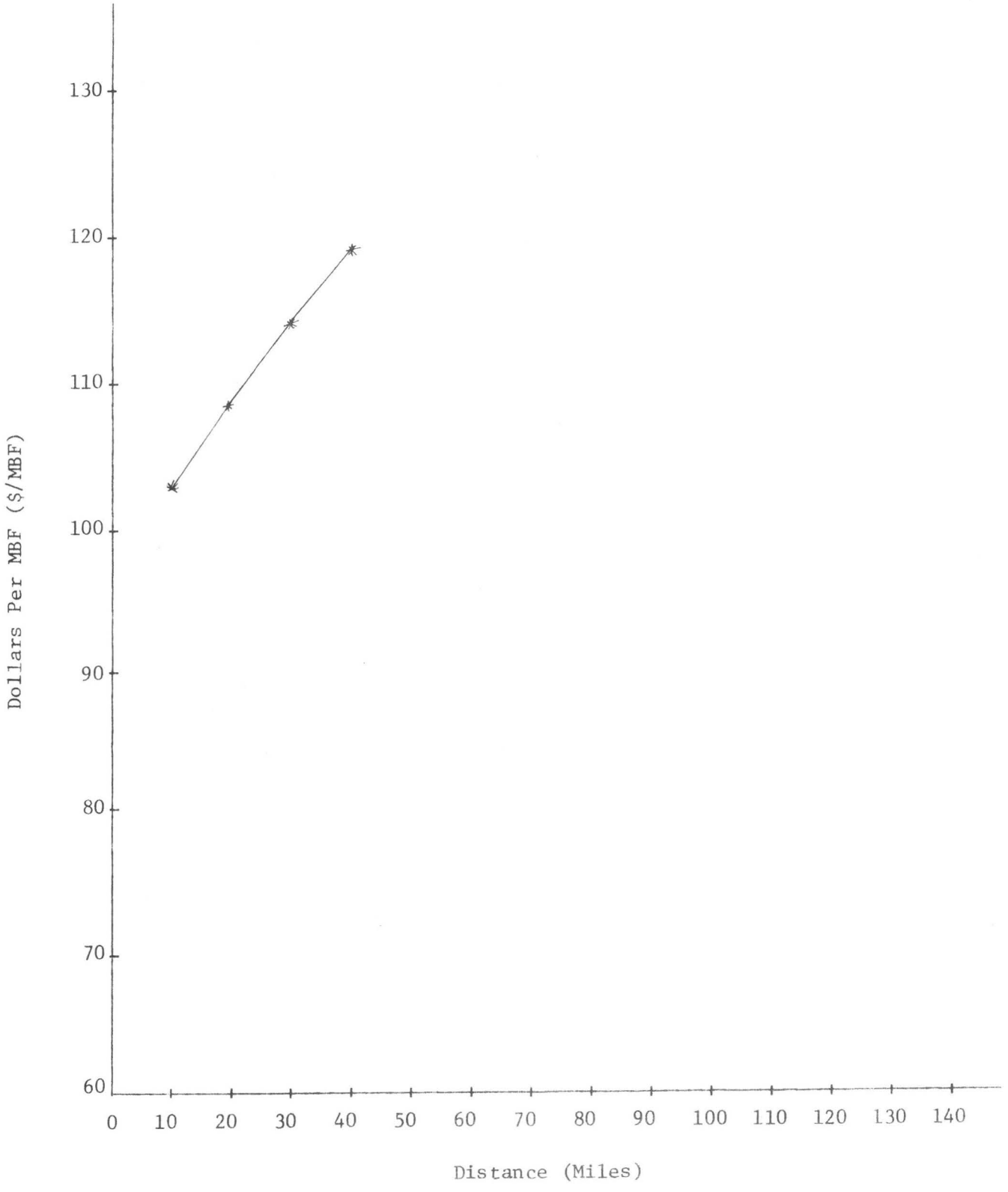

Figure V-21. Alamogordo Aggregate Supply Schedule by Distance.

8. Problems and Opportunities

The major problem facing timber management and wood utilization in this timbershed revolves about the small timber size. The sawtimber is generally smaller than in Arizona and the proportion of smaller-sized material within sales, because of silvicultural need and past cutting, will continue to be significant. The larger-sized sawtimber is likely to be procured only on steep slopes where cable logging is required. It would seem that from a raw material standpoint there will be increased opportunities for materials for products such as post and poles. The proximity of the timbershed to major ranching areas should allow for ample local markets. Fuelwood use might also be an outlet for smaller-sized or poor quality material.

There are no significant differences between costs of logging mixed conifer and ponderosa pine. With the higher mixed conifer lumber selling value and its somewhat larger timber size it would seem to be the preferred species in the future; especially, if the cable logging sales are expanded.

A major problem revolves about the likely reduction in allowable cut. This would not be a particularly significant problem, given current cutting rates. The depressed housing market has slowed the need for timber raw material. However, if markets improved the mill might experience some difficulty in procuring the volume of timber necessary to sustain a higher production level.

The mill will continue to enjoy an advantage relative to local markets. Its unique position and proximity to major west Texas population centers and developing "Sunbelt" communities should provide good market opportunities.

d. Espanola, Cuba, and Albuquerque, New Mexico

The three processing centers have considerable overlap in their timbersheds. They all procure timber from the Carson and Santa Fe National Forests, in many cases from the same area within the Forest. To avoid duplication regarding the timbershed description of each processing center, the federal, state, and private timber resources are discussed first for all three processing centers as a group; then the volumes available for each individual processing center are pointed out.

The same procedure applies to the cost figures. Since there is so much overlap between timbersheds, the same logging costs and sale characteristics would apply to all processing centers. Therefore, one set of cost/sale figures are calculated for the three areas. An exception to this approach involves the haul distance and haul costs used in the supply schedules. These do vary by timbershed and are calculated separately for each processing center.

The following subsections will discuss the timber resource on the Santa Fe National Forest, the Carson National Forest, and finally the timber resource on the state and private lands. The last subsection presents the cost figures applicable to all the processing centers.

1. Santa Fe National Forest

(a) Timber Characteristics

There are a total of 758,000 acres of commercial forest in the Santa Fe National Forest. This total includes 372,100 acres classified as Standard component lands, 61,300 acres of Special component lands, 317,500 acres of marginal lands, and 7,900 acres of unregulated lands (Table V-62). Within this Forest, the Special Component is composed of Travel Influence Zones, Special Management Units, and Water

Table V-62. Acres by component, Santa Fe National Forest.

Component	Acres
National Forest	1,580,704
Commercial forest	758,800
Standard	372,100
Special	61,300
Marginal	317,500
Unregulated	7,900

Source: Timber Management Plan, Santa Fe National Forest, July, 1975.

Influence Zones. The Marginal component contains areas which are inaccessible or not operable given present logging systems. No programmed allowable harvest is planned for this component.

A substantial number of acres (317,500) of commercial forest on the Santa Fe are classified in the Marginal component. Given current prices, cable logging and/or improved access would be necessary in order to economically harvest much of the timber in this component. Logging restrictions due to the Marginal classification pertain to all of the timber types. A total of 35, 36, and 47 percent respectively of the ponderosa pine, mixed conifer, and spruce-fir acres on the Santa Fe are classified as Marginal lands (Table V-63).

There are four primary timber types growing on the Santa Fe National Forest. These are the ponderosa pine, mixed conifer, spruce-fir, and aspen types. The types are scattered throughout the Forest area. The ponderosa pine type is the most abundant and occupies 231,000 acres within the Standard component, 32,000 acres in the Special component, and 139,000 acres of Marginal lands. The mixed conifer type totals 115,000 acres of Standard component lands, 23,000 Special component acres, and 78,000 acres in the Marginal category. The spruce-fir type occurs in a much smaller area with a total of 24,000 acres in the Standard component, 4,000 acres of Special lands, and 25,000 acres of Marginal lands (Table V-63). Volumes were estimated on the basis of these acreages and the percent species breakdown. These are shown in Table V-64.

Table V-65 indicates that the majority of lands occupied by the ponderosa pine type are found on low productivity sites (< 30 cubic feet/acre/year), whereas the mixed conifer and spruce-fir types occupy a larger percentage of the higher productivity sites.

Table V-63. Acres of timber type by management component, Santa Fe National Forest.

Timber Type	Component (M Acres) Standard	Special	Marginal	Total CFL[1/]
Ponderosa pine	231	32	139	435.9
Mixed conifer	115	23	78	208.0
Spruce-fir	24	4	25	53.0
Aspen	-	1	23	36.8
	370	60	265	739.8

Source: Bob Steinhoff, Timber Management Staff, Santa Fe National Forest.

[1/] Correspondence, Timber Management, R-3.

Table V-64. Timber Volumes (MMBF) by Timber Type and Management Component.

Timber Type	Management Component				
	Standard	Special	Marginal	Total	Total[1/] CFL
Ponderosa Pine	918	130	497	1,545	1950.1
Douglas-fir	306	62	205	573	884.1
True fir	238	42	140	420	484.8
Spruce	204	18	162	384	539
Aspen	34	8	76	118	220.6
	1,700	260	265	3,040	4,216.5

Source: Bob Steinhoff, Timber Management Staff, Santa Fe National Forest.

[1/] Correspondence, Timber Managment Staff, R-3.

Table V-65. Proportion of timber type by productivity class (percent).

Cubic Ft/Acre/Yr	Ponderosa Pine	Mixed Conifer	Spruce-fir
120+	0 %	1 %	0 %
85 - 119	0	8	12
70 - 84	3	10	14
60 - 69	3	11	45
50 - 59	4	21	18
40 - 49	11	16	5
30 - 39	33	18	6
20 - 29	46	15	0
	100	100	100

Source: Bob Steinhoff, Timber Management Staff, Santa Fe National Forest.

Table V-66 indicates that the majority of accessible acres of softwood are occupied by timber in the 100-year and older age classes. Conversion of these over-mature stands to thrifty younger stands will serve to increase growth on the Forest.

(b) Silvicultural Prescriptions

In the past, sales have primarily involved an individual tree selection. A shelterwood system is now normally prescribed for the ponderosa pine and mixed conifer types within the Standard component. The specific type of shelterwood prescription is determined on an area by area basis. Spruce-fir prescriptions have primarily involved salvage or stand improvement treatments. The extent of these prescriptions and cutting has exceeded the calculated potential yield which has, in turn, excluded the spruce-fir type from the programmed harvest. Cutting in spruce fir is currently done where it is urgently needed because of fire, windthrow, insect infestations, or other silvicultural reasons.

Timber harvesting operations in the Special component are now conducted in order to enhance landscape values or other key resource values (e.g. watershed). Silvicultural systems prescribed for this component include selection or irregular shelterwood cuts. The selection cuts help to maintain uneven-aged stands, whereas the irregular shelterwood system insures a long regeneration period and retains a number of large, older trees in the stand. Intermediate cutting is performed in both the Standard and Special components for the purpose of improving growth and vigor in the stand. Intermediate cuts include thinning, cleaning, improvement, and salvage cutting. At present,

Table V-66. Age class distribution of accessible softwood acres, Santa Fe National Forest.

Age Class	M Acres	Percent of Total
0 - 20	45	9
21 - 40	35	7
41 - 60	50	11
61 - 80	35	7
81 - 100	25	6
100+	285	60
		100

Source: Table 2, Timber Management Plan, Santa Fe National Forest, July, 1975.

the Forest indicates there isn't a strong market for smaller-sized material for use as post and poles.

There is a fairly heavy dwarf mistletoe infestation. In the mixed conifer about 10-15% of the area is infected by either rust or dwarf mistletoe. The proportion of species infested is about the same as the natural species distribution. In cases of infestations the prescription normally involves extensive overstory removal, taking care to avoid damage to reproduction.

(c) Timber Procurement

Most of the logging is currently accomplished using conventional logging methods. Most of the Forest has been cut over once, and in some areas twice. Thus, the road system in most areas is well established.

The areas of marginal lands have not been logged as extensively. On some sites the trees are 30"+ dbh. In many cases these areas would require cable logging. There are plans to have more of these type sales but in these cases more roads will have to be built and the sale layout will have to be prepared carefully. The Forest feels it needs fully trained personnel to administer such sales before going ahead with a cable logging program. Since a large percentage of the mixed conifers (35-50%) are located on marginal lands, this type will be affected significantly by such a program.

The amount of logging residue varies from 5 to 20 tons per acre with most sales averaging 15 tons per acre. Where accessible to the public, these residues are used extensively by "free-use" firewood collectors.

The timber cut normally goes to mills in Albuquerque, Cuba or Espanola. There are some small business set-asides on the Forest. These amount to about one-third of the sales offered. There have not been any major problems in getting bidders for sales, even though many sales contain smaller-sized sawtimber (avg. 15" dbh). Both Forest and mill personnel feel that there were no appreciable differences in ponderosa pine versus mixed conifer procurement costs. The added costs of slash treatment and roads is offset by the higher volumes per acre in mixed conifers.

(d) Actual Cut, Programmed Cut, and Potential Yield

This programmed allowable cut (does not include marginal lands) on the Santa Fe National Forest has been declining slightly over the past ten years (Table V-67). The actual harvest dropped to 29.2 million feet in 1980, the second lowest cut realized over the past ten years. The current decline in actual harvest is probably due to a low demand for wood products, particularly lumber, which is a result of the current slump in housing and industrial construction.

A comparison of programmed cut and potential yield is shown in Tables V-68 and V-69. The sawtimber cut could be increased approximately four times over in the standard and special component under a potential yield program. There would also be an additional 58,000 acres of marginal land available under such a program. Potential yield volumes would probably allow for expanding the present mill capacity.

Under the new timber management plan the allowable cut is expected to be around 55 to 60 mmbf. This would involve a certain amount of cable logging. Given the present mill sizes, there would be adequate capacity to handle this increased cut.

Table V-67. Actual cut and allowable cut, Santa Fe National Forest.

Period or Year	Actual Harvest (MMBF)	Average Annual	Allowable Cut (MMBF)
1941-1950	237.0	(26.3)	-
1951-1960	226.0	(25.1)	-
1961-1970	419.0	(46.6)	-
1971	62.3		46.1
1972	56.6		46.1
1973	37.9		46.1
1974	30.9		46.1
1975	28.7		46.1
1976	62.2		41.0
1977	34.9		41.0
1978	44.8		41.0
1979	40.0		41.0
1980	29.2		40.8

Source: Bob Steinhoff, Timber Management Staff, Santa Fe National Forest.

Table V-68. Programmed allowable harvest, Santa Fe National Forest, by management component and type of harvest.

Management Component and Type of Harvest	M Acres	Sawtimber MMBF
Standard		
Shelterwood		
Seed Cuts	1.7	9.0
Removal	6.4	23.6
Intermediate	3.1	4.7
Standard Total	11.2	37.3
Special Total	5.0	3.7
Marginal Total	-	-

Source: Timber Management Plan, Santa Fe National Forest, July, 1975.

Table V-69. Potential yield, Santa Fe National Forest, by management component and type of harvest.

Management Component and Type of Harvest	M Acres	Sawtimber MMBF	Products M Cunits	Products M Cords
Standard				
Shelterwood				
Seed Cuts	7.0	35.9	13.6	16.5
Removals	25.4	94.6	36.0	43.9
Intermediate	12.5	18.8	7.2	8.8
Standard Total	44.9	149.3	56.8	69.2
Special Total	19.8	14.8	5.6	6.8
Marginal Total	57.8	193.0	73.4	89.5

Source: Timber Management Plan, Santa Fe National Forest, July, 1975.

(e) Fuelwood Use

Over the last five years the fuelwood market seems to be relatively stable (Table V-70). Piñon is the preferred species; however, fuelwood is also procurred from logging or TSI slash. There are a large number of local users in the "dependent community" category. According to the Forest the intensity of this fuelwood market (17,000 to 25,000 users) has "cleaned up" a good deal of the logging residues.

The Forest charges $1.50/cord for fuelwood for personal use, $3.50/cord for a commercial sale. The users are scattered about locally, with Albuquerque being the largest single source of demand.

2. Carson National Forest

(a) Timber Characteristics

There are a total of 709,965 acres of commercial forest land on the Carson National Forest. This total involves 322,400 acres classed as Standard component lands. Approximately 80% of these lands are within the Espanola and Albuquerque timbersheds. The remainder of these lands are within the Jicarilla and Questa Ranger Districts. Special component lands total 24,717 acres and marginal lands total 254,000 (Table V-71). The bulk of the Standard and Special lands are occupied by softwoods (Table V-72). A significant portion of the marginal lands (one-third) are occupied by aspen. These marginal lands are either inaccessible or are considered too steep for conventional logging. Most of these areas are adjacent to canyons or at the head of drainages. The unregulated component is made up largely of recreational sites (Table V-73).

The majority of the softwoods are in the 60 to 100 year age range (66%) (Table V-74). Most of this is smaller-sized sawtimber. There

Table V-70. Fuelwood Use.

	Commercial Cut (Cords)	Free Use (Cords)
1976	N/A	31,084
1977	N/A	35,598
1978	7,986	29,422
1979	12,434	36,700
1980	6,289	19,699

Source: Annual Reports, Santa Fe National Forest.

Table V-71. Carson N.F. Land Use Classification.

	M Acres	MMBF Volume
Gross N.F.	1,491.647	
Private or state owned	100.847	
Commercial	709.965	
Nonforest	331.6	
Productive reserved	31.6	
Productive deferred	68.0	
Standard component	322.4	1183.4
Special component	24.7	85.3
Travel & water infl. zones	19.7	
Backdrop areas	5.0	
Marginal	254.0	1413.1
Inoperable	38.6	
Unregulated component	11.1	
Unproductive	316.7	
Net N.F. Total	1,390.8	

Source: Timber Management Plan, Carson National Forest, p. 2, 3, 21.

Table V-72. Land Use Classification, Softwoods.

	M Acres	MMBF Volume
Nonforest	331.6	
Productive - Reserved	31.6	
Productive - Deferred	65.5	
Standard component	320.4	1,178.4
Special component	22.4	78.8
Travel & water infl. zones	17.5	
Backdrop areas	4.9	
Marginal component	204.8	1,188.4
Unregulated component	10.9	
Unproductive forest	316.7	
Net N.F. Total	1,304.9	

Source: Timber Management Plan, Carson National Forest, p. 4.

Table V-73. Classification of Productive Forest Land, Carson N.F.

Component or Land Classification	Acres
Standard (Technical)	319,527
Special (Administrative)	24,717
Marginal	
Non-Stocked	12,712
Aspen	79,216
Inaccessible	19,699
Other	174,948
Productive deferred	68,023
Unregulated	
Developed rec. sites	1,810
Planned rec. sites (20 yrs.)	4,483
Base in exchange	357
Summer home areas	113
Administrative site	5
Hydrothermal formations	855
Moly Coop unit	3,500

Source: Timber Management Plan, Carson National Forest, p. 968.

Table V-74. Softwoods Volumes by Age Class, Carson N.F.

Age Class	DBH	Cu. Ft.	MBF	Percent
21-40	5.0- 8.9	145,419		
41-60	9.0-10.9		237,610	8.29
61-80	11.0-15.9		1,190,291	41.52
81-100	16.0-19.9		732,888	25.56
101-120	20.0-23.9		365,777	12.76
121+	24.0+		340,159	11.87
			2,866,725	100.00

Source: TMP, Carson N.P., p. 69.

are some areas with virgin timber of fairly large size. Most of these areas are occupied by mixed conifers. The Forest estimates that 35% of the mixed conifer is on marginal lands with dbh ranging from 28"-30" (Table V-75).

The species distribution on the Forest (CFL) involves ponderosa pine (34%), mixed conifer (29%), spruce-fir (23%), and aspen (14%) (Table V-76). This Forest has a more diversified set of species than do most others in the Southwest which are largely ponderosa pine. The Forest has predominantly Site II and Site III site class categories (Table V-77).

(b) Silvicultural Prescriptions

Silvicultural objectives include even-aged management for sustained-even flow sawtimber production within the Standard component lands. A broad shelterwood system is utilized with a 120-year rotation, in order to encourage harvest of sawtimber-sized trees in the 20-24 inch diameter class. Compartment entries are made approximately every 20 years for thinning or harvest cuts. Site class, level of mistletoe infestation and multiple use considerations are used to establish priorities for timber stand improvement and reforestation. In some cases a group-shelterwood material is utilized when patches of advanced reproduction occur in stands due to previous thinnings or natural distributions. Aspen and spruce are generally clearcut. The Forest is practicing a limited amount of individual tree selection (light) on a trial basis in a few selected spruce sites.

The Forest feels the silvicultural program is generally ahead of insects and disease problems, but there has been a recent spruce beetle infestation in the northern portion of the Forest. Currently there

Table V-75. Annual Net Growth Rate of Standard and Special Component Softwoods Only.

	Total	Per Acre
Standard	9,622 mbf	31 bf/A
Special	652 mbf	37 bf/A
Mixed conifer		
Virgin	36.8%	7,900,000 mbm
Cut	18.0%	4,000,000 mbm
Spruce		
Virgin	18.7%	4,100,000 mbm
Cut	10.6%	2,350,000 mbm
Pine		
Virgin	4.5%	1,050,000 mbm
Cut	11.4%	2,500,000 mbm

Source: TMP, Carson National Forest, p. 72.

Table V-76. Species Distribution for the Carson National Forest.

	Pine	S.W. White Pine	DF	Subalpine Fir	White Fir	Spruce	Aspen
M Acres (comm)	207.1 (34.0%)	1.1 (0.2%)	145.5 (23.9%)	65.4 (10.8%)	28.9 (4.8%)	71.0 (11.7%)	89.0 (14.6%)
Volume* (mmbf)	886.8	17.0	479.5	221.7	265.7	647.6	130.5

* Volume by international rule.

Source: Mr. Bill Shapiro, USDA Forest Service, Region 3.

Table V-77. Inventory Data, Carson National Forest.

Total net Forest land area	1,392,278 acres
Commercial Forest land	709,965 acres
Productive reserved	31,629 acres

Productivity class

Site Class	Acres	Percent
I (75+)	10,270	1.6
II (55-74)	318,382	49.6
III (54-)	313,247	48.8

Source: Timber Management Plan, Carson National Forest, p. 19, 69.

are some areas of spruce budworm and mistletoe infestation that do require modifying the silvicultural prescription involving, perhaps, 25% of the sales.

Timber production is a secondary or minor management objective on the Special component lands. Here timber harvest is performed in such a way as to minimize the impact on the water quality and visual quality resources. In this component, an irregular shelterwood method is prescribed. This method is characterized by a long regeneration period in which some of the dominant trees are retained to reach maximum size.

Within the Marginal component, lands that are now considered too steep to log using conventional equipment will eventually be placed in the Standard component if cable logging systems can be used. These areas include primarily virgin mixed conifer and spruce-fir types. In these stands shelterwood cuts and strip, patch and stand clearcuts will be utilized.

(c) Timber Procurement

Most of the logging is accomplished by conventional methods. The Forest is now combining cable logging sales with conventional systems on a volume ratio of 5:2. There are now three cable sales planned for FY 1982.

Prior to 1975 the cut was heavily weighted to ponderosa pine. However, this is no longer the case and proportionally there is a good mix of species harvested. The Forest is trying to increase the cutting of aspen and the utilization of post and pole size material of all species.

The Forest feels the mixed conifers involve some added procurement costs (25% higher). This is contrary to industry's opinion of no

difference. This is due to the fact that mixed conifer harvests involve longer log hauls, a shorter logging season, more slash, and generally steeper slopes. There is also a better road system now available in the ponderosa pine zone. In the future the Forest would like to have new roads based on total resource needs not just timber access.

The amount of logging residue varies. On a recent mixed conifer sale involving 6.017 mbf/A, the actual residue was 5.4 tons/acre. This was after the sale had been open to free-use fuelwood collectors. If it had not had such use the Forest estimates the residues would be 25-30 tons per acre. Volumes of residue per acre are generally higher for spruce-fir and lower for ponderosa pine.

(d) Actual Cut, Programmed Cut, and Potential Yield

The actual harvest on the Carson N.F. is listed in Table V-78 for the fiscal years 1963 through 1974. The data indicate that the cut increased over time with the exception of the years 1970 and 1971 which showed a slight decline in harvest over the level of cut in 1969. About one-half of the sales on the Forest are small business set-asides.

The programmed cut was considerably higher during the 1960's and early 1970's than the actual cut (Table V-79). The current plan's programmed cut is now much closer to the actual harvest.

The potential yield figures are given in Table V-80. The sawtimber cut would be considerably higher than the current programmed harvest, almost seven times more. Given the potential yield of this Forest and the Santa Fe National Forest combined, there would seem to be opportunities for expanding mill capacity if such a harvest program could be implemented.

Table V-78. Record of Actual Harvest for FY '63 - FY '74, Carson National Forest.

FY	Sawtimber MBF	Allowable Cut MBF
1963	11,534	47,100
1964	10,372	"
1965	17,448	"
1966	17,930	"
1967	11,690	"
1968	27,255	"
1969	37,495	"
1970	20,030	"
1971	26,380	"
1972	35,190	"
1973	35,029	"
1974	38,667	26,600
1975	25,400	"
1976	30,094	"
1977	30,794	"
1978	20,740	"
1979	26,635	"
1980	18,549	"

Source: Timber Management Plan, Carson National Forest, p. 24.

Table V-79. Programmed Allowable Harvest, Carson National Forest.

	M Acres	Sawtimber MMBF	Products M Cunits	Products M Cords
Standard Component				
Shelterwood removals	15.1	22.3		
Intermediate	2.1	3.1		
Stand. Total	17.2	25.4		
Special Component	.1	.2		
Marginal Component				
Aspen	.02	.2		

Source: Timber Management Plan, Carson National Forest, p. 9.

Table V-80. Potential Yield, Carson National Forest.

	M Acres	Sawtimber MMBF	Products M Cunits	Products M Cords
Standard Component				
Shelterwood				
Seed cut	9.4	24.6		
O.S. removal	48.8	74.7		
Intermetiate	3.8	5.9	22.4	28.0
Aspen	.3	.2		
Standard total	62.3	105.4	22.4	28.0
Special Component				
Softwoods	2.6	1.0		
Aspen	.5	.1		
Special total	3.1	1.1		
Marginal Component				
Reforestation backlog	2.9			
TSI backlog	6.4			
Steep slopes	23.9	51.0	16.0	20.0
Aspen	12.3	17.1	11.6	14.4
Marginal total	45.5	68.1	27.6	34.4

Source: Timber Management Plan, Carson National Forest, p. 6.

(e) Fuelwood Use

The Forest has a fairly large free-use program which has remained relatively stable over the last five years (Table V-81). The Forest feels that for the present and foreseeable future, fuelwood free-use and commercial sales are their best opportunity for TSI and thinning prescriptions. Currently, they are removing about 200 mmbf per year by free-use from logging, slash and pre-commercial thinning slash. The Forest hopes to increase interest in commercial thinning of larger material (6"-9") for use as fuelwood. If funds were available for intensive timber management, the first priority would be to stimulate and administer commercial fuelwood sales via thinning. This would have to be administered carefully as the Forest has a large contingent of small dependent communities. The political atmosphere is such that a combination of free-use and commercial operations is probably appropriate.

3. State and Private Lands

Within the areas included in the Cuba, Espanola, and Albuquerque timbersheds, there are substantial amounts of timber located on state and privately owned lands. This is particularly true of Taso, Rio Arriba, Bernalillo, Sandoval, and Torrance counties. In some cases, only portions of the state and private forested areas in these counties are included within the established timbershed boundaries. However, those areas not included in the timbersheds are close enough to mills that, for purposes of this study, they could be considered accessible by the mills. This facilitates the analysis by allowing county totals to be used. This is the way the data has been compiled. There is presently no means available for disaggregating the available county data to reflect acres and volumes for the areas actually within the timbershed boundaries.

Table V-81. Annual Fuelwood Free Use, Carson National Forest.

Year	MBM
FY 1976	18,426.71
1977	15,701.60
1978	17,616.06
1979	37,814.00
1980	19,826.50

Data presented in the tables included in this section are presented in two groups. The first set contains acreage and volume statistics for Bernalillo, Sandoval and Torrance counties and the second set includes Taos and Rio Arriba counties. They are reported this way in the U.S. Forest Service Forest Survey publications. Generally, timber within Bernalillo and Torrance counties is closer to Albuquerque, whereas timber within Sandoval and Taos and Rio Arriba is closer to Espanola and Cuba's processing centers.

Bernalillo, Sandoval, and Torrance counties contain substantial amounts of state and privately owned timber resources. Tables V-82 through V-87 present acreage and volume statistics for these counties. The initial acreage estimates were obtained from 10,383 sample points placed on aerial photographs which were then summarized and grouped for later field sampling. Land classification and timber-related statistics were then obtained from a total of 349 ground sample locations. The selection of sample trees was based on 10-point clusters which included fixed plots (1/300 acre) for trees less than 5.0 inches dbh and variable plots (40 BAF) for trees 5.0 inches dbh and larger.

The majority of commerical forest land within Sandoval County is located within the Cuba timbershed. Forested areas run north from the town of Cuba approximately 20 miles to the town of Lindrith. This area is characterized by many small ownerships, the owners of which have historically not been interested in opening up their lands to logging operations. In addition, sawtimber-sized material is typically scattered in small blocks making large sales less attractive, especially to the larger mills interested in lumber production.[4/]

4/Personal communication with Dave Brown, Marketing Utilization Specialist, New Mexico State Forest Service.

Table V-82. Area of State and Private Forest Land in Bernalillo, Sandoval and Torrance Counties.

Classification	Softwood Types	Hardwood Types	Totals
	(acres)	(acres)	(acres)
Commercial timberland	68,034	14,766	82,800
Other forest land:			
Unproductive nonreserved	574,790	3,863	578,653

Source: Table 1, Forest Area and Resource Statistics for Bernalillo, Sandoval, and Torrance Counties, New Mexico, 1978, Draft USDA Forest Service Resource Bull. INT- . 1980.

Table V-83. Total Land Area by Ownership Class.

Ownership	Acres
USFS	626,010
BLM	619,581
National Park Service	29,902
BIA	894,156
State	394,154
Private and other	2,702,757

Source: Table 3, Forest Area and Resource Statistics for Bernalillo, Sandoval, and Torrance Counties, New Mexico, 1978, Draft USDA Forest Service Resource Bull. INT- . 1980.

Table V-84. Area of State and private commercial timberland in Bernalillo, Sandoval, and Torrance counties by forest type, stand-size class, and site class, 1978.

Forest type and stand-size class	Site Class				
	120+	85-119	50-84	20-49	Total
Douglas fir/White fir					
Sawtimber	-	1,933	17,874	8,268	28,075
Poletimber	-	-	644	611	1,255
Seedling/Sapling	-	-	-	-	-
Nonstocked	-	-	613	-	613
Ponderosa pine					
Sawtimber	-	-	13,314	3,691	17,005
Poletimber	-	-	1,323	1,967	3,290
Seedling/Sapling	-	-	1,254	1,820	3,074
Nonstocked	-	-	-	-	-
Spruce-Subalpine fir					
Sawtimber	-	-	671	670	1,341
Poletimber	-	-	670	-	670
Seedling/Sapling	-	-	-	607	607
Nonstocked	-	-	-	-	-
Aspen					
Sawtimber	-	661	5,852	1,253	7,766
Poletimber	611	-	662	-	1,273
Seedling/Sapling	-	-	1,829	3,237	5,066
Nonstocked	-	-	-	-	-

Table V-85. Softwood Net Volumes, net annual growth, and annual mortality of growing stock and sawtimber on commercial timberland in Bernalillo, Sandoval and Torrance Counties, 1978.

Item	Volumes	
	Growing Stock	Sawtimber
Net Volume	99,094 MCF	409,569 MBF
Net annual growth	2,436 MCF	9,389 MBF
Annual mortality	138 MCF	685 MBF

Table V-86. Net Volume of growing stock and sawtimber on commercial State and private timberland in Bernalillo, Sandoval, and Torrance counties by forest type and size class, 1978.

Forest type	Growing Stock Volume in MCF by Size Class				
	Sawtimber	Poletimber	Seed/Saps	Nonstocked	Total
Douglas fir/White fir	59,078	1,162	-	233	60,473
Ponderosa pine	17,542	1,746	634	-	19,922
Spruce/Subalpine fir	3,922	751	99	-	4,772
Aspen	21,969	2,339	1,931	-	26,239
	Sawtimber Volume in MBF by Size Class				
Douglas fir/White fir	235,697	2,507	-	963	239,167
Ponderosa pine	72,919	3,706	2,428	-	79,053
Spruce/Subalpine fir	15,758	1,234	-	-	16,992
Aspen	81,083	3,639	6,188	-	90,910

Source: Felt, Dorothy G., Forest Area and Timber Resource Statistics for Bernalillo, Sandoval, and Torrance Counties, New Mexico, 1978, Draft INT- . (Tables 13 and 14.)

Table V-87. Net Volume of growing stock and sawtimber on commercial timberland in Bernalillo, Sandoval, and Torrance counties, by ownership and species, 1978.

Ownership class	Douglas fir	White fir	Ponderosa pine	Spruce[1/] fir	Aspen
			Sawtimber Volume in MBF		
State	983	349	788	413	679
Private	164,523	63,429	95,731	71,958	94,021
Total	165,506	63,776	96,519	72,371	94,700
			Growing Stock Volume in MCF		
State	206	95	210	111	198
Private	35,033	17,639	22,406	20,206	29,035
Total	35,239	17,734	22,616	20,317	29,233

Source: Felt, Dorothy G., Forest Area and Timber Resource Statistics for Bernalillo, Sandoval, and Torrance Counties, New Mexico, 1978, Draft INT- . (Table 17.)

[1/] Includes Engelmann spruce and subalpine fir.

Another large privately owned concentration of commercial Forest land in Sandoval County is the Baca Location No. 1 (90,000 acres) which lies within the boundaries of the Santa Fe National Forest and the Espanola and Albuquerque timbersheds. This area has been heavily cutover in the past and the present owner is currently attempting to regenerate the area and is not offering a significant amount of timber for sale. The New Mexico State Forest Service is currently providing assistance to develop a timber management program. They are looking into a small cable system to use in a portion of the area. The Jemez Springs area is another location that contains substantial amounts of privately owned timber. Again, the many small ownerships make large timber sales unlikely in this area. In addition, heavy emphasis in this area is placed on recreational opportunities instead of timber production.[5/]

The same pattern of small ownerships exists in both Bernalillo and Torrance counties. Much of the resource in these counties is in the poletimber class which further contributes to a lack of timber sales from state and private lands.[6/] In Torrance County, many of the forested areas are occupied by the pinyon-juniper types. These particular species are not utilized by the larger mills but instead are used primarily by individuals and small operators interested in fuelwood supplies.

Within Rio Arriba County, a large percentage of the total state and private timber resources lie within the areas directly to the west of the Carson National Forest boundaries running north from the town of Cebolla to the Colorado border and stretching west into the Jicarilla Indian reservation. The majority of timber sales occurring on these

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[5/] Ibid.

[6/] Ibid.

lands are purchased by mills located in Chama, New Mexico, or Pagosa Springs, Colorado rather than the processing centers considered here.[7/] These particular areas were not included in the timbersheds defined earlier. Statistics for both Taos and Rio Arriba County are contained in Tables V-88 through V-93.

Taos County contains a number of small ownerships of timber located around the town of Taos. Many of the timber owners in this area are interested primarily in recreational development and consequently are not interested in opening up their lands to logging. A considerable timber resource also exists on the Taos de Pueblo Indian Reservation. These lands, however, have been removed from timber production due to policies established by the Tribal Council.

In conclusion, there are substantial amounts of timber on state and private lands that could be considered accessible by the larger mills in Cuba, Espanola, and Albuquerque. However, deterrents to sales on these lands exist in the form of many small ownerships, scattered "pockets" of sawtimber, and policies established by the various landowners including Indian tribes, ranchers, and individuals oriented towards recreational development. In addition, the mills that form the basis for the timbersheds defined above have historically obtained most, if not all, of their raw materials from federally owned lands operated by the U.S. Forest Service. Therefore, the assessment of volumes available will include these volumes as they exist on a county basis; but the development of supply schedules will include only those volumes available from federal lands.

[7/] Personal communication with Dave Brown, Marketing Utilization Specialist, New Mexico State Forest Service.

Table V-88. Net Volume of growing stock and sawtimber on commercial timberland in Taos-Rio Arriba Working Circle, by ownership and species, 1978.

Ownership Class	Douglas fir	White fir	Ponderosa pine	Spruce[1/] fir	Aspen
			Sawtimber Volume in MBF		
State	4,784	3,752	11,241	15,759	5,493
Private	100,941	91,780	119,819	568,195	129,966
Total	105,725	95,532	131,060	583,954	135,459
			Growing Stock Volume in MCF		
State	1,319	1,074	2,706	4,275	2,753
Private	26,930	25,294	28,116	151,333	65,644
Total	28,249	26,368	30,822	155,608	68,397

Source: Barrett, Michael K. and Dorothy Felt. Forest Area and Timber Resource Statistics for the Taos-Rio Arriba Working Circle, New Mexico, 1977, USDA Forest Service INT-21. 24p. Table 17.

[1/] Includes Engelmann spruce and subalpine fir.

Table V-89. Area of State and Private Forestland for the Taos-Rio Arriba Working Circle, 1977.

Classification	Softwood Acres	Hardwoods Acres	Total
Commercial timberland	228,573	64,799	293,372
Other forestland			
Unproductive reserved	-	-	-
Unproductive nonreserved	216,671	141,932	358,603

Source: Barrett, Michael K. and Dorothy Felt. Forest Area and Timber Resource Statistics for the Taos-Rio Arriba Working Circle, New Mexico, 1977, INT-21, Table 1, p. 5.

Table V-90. Net Volume, Net Annual Growth, and Annual Mortality of Growing Stock and Sawtimber for Taos-Rio Arriba Working Circle, 1977.

	Softwood Volume	Hardwood Volume	Total
Net Volume:			
Growing stock (MCF)	242,549	72,775	315,324
Sawtimber (MBF)	921,275	148,651	1,069,926
Net annual growth:			
Growing stock (MCF)	6,845	2,066	8,911
Sawtimber (MBF)	31,293	8,206	39,499
Annual mortality:			
Growing stock (CF)	423,340	268,565	691,905
Sawtimber (BF)	1,416,853	516,609	1,933,462

Source: Barrett, Michael K. and Dorothy Felt. Forest Area and Timber Resource Statistics for the Taos-Rio Arriba Working Circle, New Mexico, 1977, INT-21, Table 2, p. 5.

Table V-91. Total Area in the Taos-Rio Arriba Working Circle by Ownership Class, 1977.

Ownership Class	Acres
National Forest	1,894,376
Bureau of Land Management	740,422
Indian	757,236
State	261,083
Private	1,529,987

Source: Barrett, Michael K. and Dorothy Felt. Forest Area and Timber Resource Statistics for the Taos-Rio Arriba Working Circle, New Mexico, 1977, INT-21, Table 3, p. 10.

Table V-92. Area of State and private commercial timberland in the Taos-Rio Arriba Working Circle by Forest type, stand-size class, and site class, 1977.

Forest Type and Size Class	Site Class 120+	85-119	50-84	20-49	Totals
Douglas-fir/White fir					
Sawtimber	-	1,820	24,589	21,375	47,784
Poletimber	-	-	-	2,071	2,071
Seedling/Sapling	-	-	1,971	3,831	5,802
Nonstocked	-	-	-	3,941	3,941
Total	-	1,820	26,560	31,218	59,598
Ponderosa pine					
Sawtimber	-	-	9,620	30,055	39,675
Poletimber	-	-	1,926	-	1,926
Seedling/Sapling	-	-	-	1,883	1,883
Nonstocked	-	-	-	5,963	5,963
Total	-	-	11,546	37,901	49,447
Spruce-Subalpine fir					
Sawtimber	-	5,575	47,536	40,169	93,280
Poletimber	-	-	9,657	1,903	11,560
Seedling/Sapling	-	1,806	-	9,270	11,076
Nonstocked	-	-	-	-	-
Total	-	7,381	57,193	51,342	115,916
Aspen					
Sawtimber	-	2,163	22,736	11,866	36,765
Poletimber	-	5,509	4,326	5,837	15,672
Seedling/Sapling	-	-	4,327	3,989	8,316
Nonstocked	-	-	-	-	-
Total	-	7,672	31,389	21,692	60,753

Source: Barrett, Michael K. and Dorothy Felt. Forest Area and Timber Resource Statistics for the Taos-Rio Arriba Working Circle, New Mexico, 1977, INT-21, Table 7, p. 13.

Table V-93. Net volume of growing stock and sawtimber on commercial State and private commercial timberland in the Taos-Rio Arriba Working Circle.

Forest Type	Growing stock volume (MCF) by Size Class				
	Sawtimber	Poletimber	Seeds/Saps	Nonstocked	Total
Douglas fir-White fir	52,938	1,148	1,976	733	56,795
Ponderosa pine	25,698	559	343	729	27,329
Spruce-Subalpine fir	132,684	12,464	2,987	-	148,135
Aspen	58,044	18,369	2,221	-	78,634
	Sawtimber volume (MBF) by size class				
Douglas fir-White fir	179,671	2,658	7,515	3,134	195,636
Ponderosa pine	105,498	1,358	816	3,652	111,351
Spruce-Subalpine fir	492,337	20,594	10,722	-	523,653
Aspen	195,400	24,380	7,052	-	226,832

Source: Barrett, Michael K. and Dorothy Felt. Forest Area and Timber Resource Statistics for the Taos-Rio Arriba Working Circle, New Mexico, 1977, INT-21, Tables 13, 14.

4. Procurement Costs

Tables V-94 and V-95 contain the descriptive statistics concerning procurement costs for the three timbersheds. Table V-94 separates these statistics by mixed conifer and ponderosa pine sales and compares the means of variables to determine if a statistically significant difference exists.

Given the appraisal figures used here there is a significant difference between mixed conifer and ponderosa pine in the areas of defect and mill overrun and in the lumber selling value. Interestingly, total production cost is somewhat less for mixed conifers than for ponderosa pine, by about $40/mbf. However, because of mixed conifer lower lumber selling value, the percent total cost of selling value is about the same for both, 70%.

The sale sizes and timber size are relatively the same for both species types. Hauling distance is somewhat less, generally, than for ponderosa pine. The slash lopping and scattering costs per acre are definitely higher for mixed conifers. However, the total slash disposal costs per mbf between the sales are not much different. Ponderosa pine is more expensive. The major cost difference seems to be manufacturing costs which are nearly $30/mbf more for ponderosa pine. All things considered the logging costs are reasonably the same for both species types.

Table V-94. Espanola, Cuba and Albuquerque Timbershed Summary Statistics Broken Down by Species.

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between the Means
1. Acres	Acres				
Mixed conifer (M.C.)		2235.1	425.0- 7437.0	2169.3	No
Ponderosa pine (P.P)		2459.9	1282.0- 3806.0	864.9	
2. Sale volume	Scribner MBF				
M.C.		5973.1	2220.0-11400.0	3312.9	No
P.P		6813.0	880.0-12700.0	4394.8	
3. Average Sale DBH	Inches				
M.C.		18.5	13.5- 23.1	2.8	No
P.P.		17.1	13.6- 20.0	2.0	
4. Average Sale Defect	Percent				
M.C.		23.5	14.5- 31.9	4.7	Yes
P.P.		18.9	11.0- 24.0	4.2	
5. Average Overrun	Percent				
M.C.		33.6	27.9- 37.0	2.7	Yes
P.P.		37.2	33.0- 42.5	3.1	
6. Hauling distance, sale-to-mill	Miles				
M.C.		53.7	35.0- 118.0	29.0	No
P.P.		78.3	27.0- 132.0	43.5	
7. Hauling cost, sale-to mill	Cost per MBF				
M.C.		21.82	15.71- 41.35	7.67	No
P.P.		26.15	7.24- 55.26	14.44	

Table V-94 (con't)

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between the Means
8. Selling Value, lumber tally	$ Per MBF				
M.C.		199.76	151.75-250.47	32.93	No
P.P.		232.21	129.47-277.34	43.24	
9. Selling value, log scale	$ Per MBF				
M.C.		294.86	260.43-339.51	25.39	Yes
P.P.		337.94	266.95-402.51	41.37	
10. Stump-to-truck, logging cost	Cost per MBF				
M.C.		41.38	20.85- 84.81	17.34	No
P.P.		45.28	24.58- 65.88	13.94	
11. Environmental protection cost	Cost per MBF				
M.C.		11.47	6.71- 24.16	5.43	No
P.P.		16.33	7.18- 33.72	8.35	
12. Temporary road cost	Cost per MBF				
M.C.		.95	.25- 2.48	.81	No
P.P.		2.05	.15- 5.21	1.65	
13. Temporary road requirements	Miles				
M.C.		1.3	0- 7.0	2.2	No
P.P.		2.5	0- 7.0	2.6	

Table V-94 (con't)

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between the Means
14. Specified road cost	Cost per MBF				
M.C.		35.76	13.55- 54.99	16.71	No
P.P.		40.03	13.02- 65.93	21.23	
15. Specified road requirements	Miles				
M.C.		4.5	0 - 16.0	5.6	No
P.P.		3.6	0 - 15.0	5.2	
16. Slash piling cost	Cost per acre				
M.C.		56.95	2.38-102.60	27.38	No
P.P.		59.73	21.46-129.87	34.01	
17. Slash lopping and scattering cost	Cost per acre				
M.C.		33.96	10.00-241.77	62.65	No
P.P.		16.75	9.76- 40.00	10.65	
18. Total slash disposal cost	Cost per MBF				
M.C.		10.45	4.64- 23.08	5.67	No
P.P.		14.80	6.91- 28.45	7.09	
19. Road maintenance cost	Cost per MBF				
M.C.		2.58	.22- 8.99	2.31	No
P.P.		2.76	.91- 7.07	1.80	

Table V-94 (con't)

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between the Means
20. General logging overhead	Cost per MBF				
M.C.		10.93	8.39- 14.30	2.22	No
P.P.		12.05	7.29- 14.30	2.26	
21. Manufacturing cost	Cost per MBF				
M.C.		126.97	96.82-153.40	22.71	No
P.P.		155.05	97.06-298.49	54.03	
22. Total production cost (w/road cost)	Cost per MBF				
M.C.		225.88	154.73-294.22	47.24	No
P.P.		270.32	193.70-416.51	68.97	
23. Total production cost (w/o road cost)	Cost per MBF				
M.C.		204.21	155.04-265.45	40.50	No
P.P.		245.57	150.52-415.09	70.07	
24. Average advertised rate	$ Per MBF				
M.C.		58.26	2.49-101.24	38.46	No
P.P.		58.67	2.78-133.84	54.14	

Table V-94 (con't)

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation	Significant Difference Between the Means
25. Average advertised rate divided by total production cost w/o road costs	Percent				
M.C.		32	1-58	23	No
P.P.		29	1-67	29	
26. Average advertised rate divided by selling value, log scale	Percent				
M.C.		19	01-32	13	No
P.P.		17	01-35	15	
27. Total production cost w/o road cost divided by selling value, log scale	Percent				
M.C.		70	55-102	16	No
P.P.		73	52-121	21	

Table V-95. Summary Statistics for Espanola, Cuba and Albuquerque Timbershed, All Sales Combined Regardless of Species.

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation
1. Acres	Acres	2332.8	425.0- 7437.0	1698.8
2. Sale volume	Scribner MBF	6340.4	880.0-12700.0	3751.2
3. Average sale DBH	Inches	17.8	13.5- 23.1	2.5
4. Average sale defect	Percent	21.5	11.0- 31.9	5.0
5. Average overrun	Percent	35.2	27.9- 42.5	3.4
6. Hauling distance sale-to-mill	Miles	65.1	27.0- 132.0	37.0
7. Selling value, lumber tally	$ Per MBF	213.87	129.47- 277.34	40.34
8. Selling value, log scale	$ Per MBF	313.59	260.43- 402.51	39.10
9. Stump-to-truck logging cost	Cost per MBF	43.08	20.85- 84.81	15.73
10. Environmental protection cost	Cost per MBF	13.58	6.71- 33.72	7.12
11. Temporary road costs	Cost per MBF	1.50	.15- 5.21	1.38
12. Temporary road requirements	Miles	1.83	0- 7.0	2.4
13. Specified road costs	Cost per MBF	37.59	13.02- 65.93	18.13
14. Specified road requirements	Miles	4.1	0- 16.0	5.4
15. Slash piling cost	Cost per acre	58.08	2.38- 129.87	29.51

Table V-95 (con't)

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation
16. Slash lopping and scattering cost	Cost per acre	26.48	9.76-241.77	47.57
17. Total slash disposal cost	Cost per MBF	12.34	4.64- 28.45	6.55
18. Road maintenance cost	Cost per MBF	2.65	.22- 8.99	2.06
19. Hauling cost, sale-to-mill	Cost per MBF	23.71	7.24- 55.26	11.06
20. General logging overhead cost	Cost per MBF	11.41	4.29- 14.30	2.26
21. Manufacturing cost	Cost per MBF	139.18	96.82-298.49	40.97
22. Total production costs w/road costs	Cost per MBF	245.20	154.73-416.51	60.58
23. Total production costs w/o road costs	Cost per MBF	222.19	150.52-415.09	57.82
24. Average advertised rate	$ Per MBF	58.44	2.49-133.84	44.79
25. Average advertised rate divided by total cost w/o road cost	Percent	31	1-67	25

Table V-95 (con't)

Variable and Species	Unit of Measure	Mean Value	Range	Standard Deviation
26. Average advertised rate divided by selling value, log scale	Percent	18	1- 35	13
27. Total production cost w/o road cost divided by selling value, log scale	Percent	71	52-121	18

5. Espanola, New Mexico

(a) Mill and Wood Product Markets

The largest wood products manufacturer in the Espanola timbershed is the Duke City Lumber Company mill located in Espanola, New Mexico. This mill has an estimated annual production of 25,000 mbf. Ponderosa pine, Douglas-fir, and white fir are the major species used. Equipment used is identical to that at the Cuba mill. Lumber and chips are the two main products manufactured.

This mill procures timber from a number of sources, 60 percent from U.S. Forest Service, 20 percent from private, and 20 percent from Indian owerships. The 20 percent from private land comes from one area, the Vermillo Grant. This mill began cutting in this area about 2-3 years ago. The 20 percent from Indian lands comes from the Picuris Indian Reservation and is another recent sale obtained about 2 years ago. Ordinarily the mill procures most of its timber from the U.S. Forest Service.

About 80 percent of the raw material is ponderosa pine, 20 percent mixed conifer. The mill produces primarily dimension lumber (75 percent) and some planed boards (25 percent). There is also a small amount of aspen paneling manufactured (< 250 mbf/year). The shavings (40 mcf/mo) and chips (120 mcf/mo) are shipped to the pulpmill in Snowflake, Arizona. The sawdust is burned.

The mill markets through wholesalers that deal with large volume orders. The key market areas are New Mexico, Texas, Oklahoma and Missouri. Practically all this material is shipped by truck because it is cheaper and involves considerably less handling.

The mill feels dimension lumber is its best product in that the price is relatively more stable and provides for a "volume" operation. Most of the mixed conifer dimension lumber is sold as framing material for homes. All lumber is sold air dry to approximately 17 percent. The mill indicates there is no problem in air drying in the summer but there are some problems from November through March. It takes considerably longer to air dry materials during this time period. Therefore, during the winter months a good deal of lumber is shipped to Albuquerque to be dried in the company's distribution yard located there.

(b) Timbershed Area[8/]

Areas of the Santa Fe National Forest occupied by the Espanola timbershed include portions of the Coyote, Tesuque, and Espanola districts. Of the 183,000 acres (standard component, sawtimber) in the Espanola District, 118,000 acres is shared with the Albuquerque timbershed. Table V-96 contains the timbershed characteristics of the timbershed based in the Santa Fe National Forest. The volume figures in Table V-96 were dervied by multiplying the acreage estimates by per acre volume figures.

The Carson National Forest supplies timber to both Albuquerque and Espanola processing centers. Both centers procure timber from the same areas of the Forest. Therefore, the timbersheds on the Carson will be identical for both Albuquerque and Espanola. These timbersheds occupy approximately 60 percent of the total acreage on the Carson. The area includes the Canjilon, El Rito and Taos ranger districts, the southern

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[8/] In order to estimate timber volumes by timbershed, it was necessary to assume that the timber volumes within the Standard component lands were distributed evenly among these timbersheds. It was also assumed that the species were evenly distributed throughout the Standard component lands. While these assumptions may result in some inaccuracies, they do provide some estimate as to how the timber is distributed throughout the Forest. It is the only means to derive these figures, as there is no more definitive data available.

Table V-96. Characteristics of the Espanola Timbershed, Sante Fe National Forest.

	District						
	Coyote	Percent of District Total Acres	Fesuque	Percent of District Total Acres	Espanola	Percent of District Total Acres	Timbershed Total
Total Acres (M)	160	64%	50	24%	183	77%	393
Standard Component Acres (M)	89		25		36		150
Acres (M) of Standard Component by Species							
Ponderosa Pine	58		14		23		95
Mixed Conifer	26		10		9		45
Spruce-fir	5		1		4		10
Volumes (mmbf) of Standard Component							
Ponderosa Pine	191		46		76		313[1/]
Mixed Conifer	101		39		35		175
Spruce-fir	29		6		23		58

[1/] These volumes were derived by multiplying the individual district acreages by 3.3 mbf/acre for ponderosa pine, 3.9 mbf/acre for mixed conifer (Douglas fir, white fir), and 5.8 mbf/acre for spruce.

portion of the Tres Piedras District, and the northwest portion of the Penasco District.

There is no data available by District concerning timber species and volumes on the Carson National Forest. Approximately 80 percent of the standard component lands are located in the timbershed. Given this figure and the acreage estimate for the standard component, a volume by species can be estimated using the percentages in Table V-76 and estimates of volume per acre by species in the standard component (pg. 75, TMP). These estimates are shown in Table V-97. The total amount of acreage in the timbershed, Santa Fe and Carson National Forests combined, is given in Table V-98. Figure V-22a shows the timbershed area.

(c) Supply Schedules

Although the Espanola mill has a fairly good road system (Table V-99) available, the mill must travel some distance to procure timber, generally 20 to 60 miles. In this timbershed volumes available in mixed conifer and ponderosa pine follow the same pattern in that both have a "bell shaped" distribution relative to distance. The volumes available are greatest midway, at about 30 miles distance from Espanola (Tables V-100 through V-103).

The costs of procurement are relatively the same for both with ponderosa pine being slightly higher per mbf. The volumes are fairly evenly distributed within each type but ponderosa pine has larger total volumes, particularly closer to the mill. This causes the costs to rise more rapidly at closer distances to the mill (in the aggregate case, Table V-104). As the distance from the mill increases the volumes become reasonably the same. The cheaper mixed conifer, coupled with the more expensive pine, then results in total smaller changes in cost per mbf.

Table V-97. Characteristics of The Espanola Timbershed, Carson National Forest, Standard Component, Sawtimber.

	Acres (M)	Volume (MMBF)
Total Standard Comp.	257.9	946.7
Ponderosa Pine	87.7	289.4[1/]
Mixed Conifer	74.8	291.7
Spruce Fir	58.0	336.4

[1/] Figures based on 3.3 mbf/A for Ponderosa Pine, 3.9 mbf/A for Mixed Conifer, and 5.8 mbf/A for Spruce Fir.

Table V-98. Total Acreage and Volumes Available, Espanola Timbershed, Standard Component Sawtimber.

	Acres (M)	Volume (MMBF)
Total Standard	407.9	1,492.7
Ponderosa Pine	182.7	602.4
Mixed Conifer	119.8	466.7
Spruce Fir	68.0	394.4

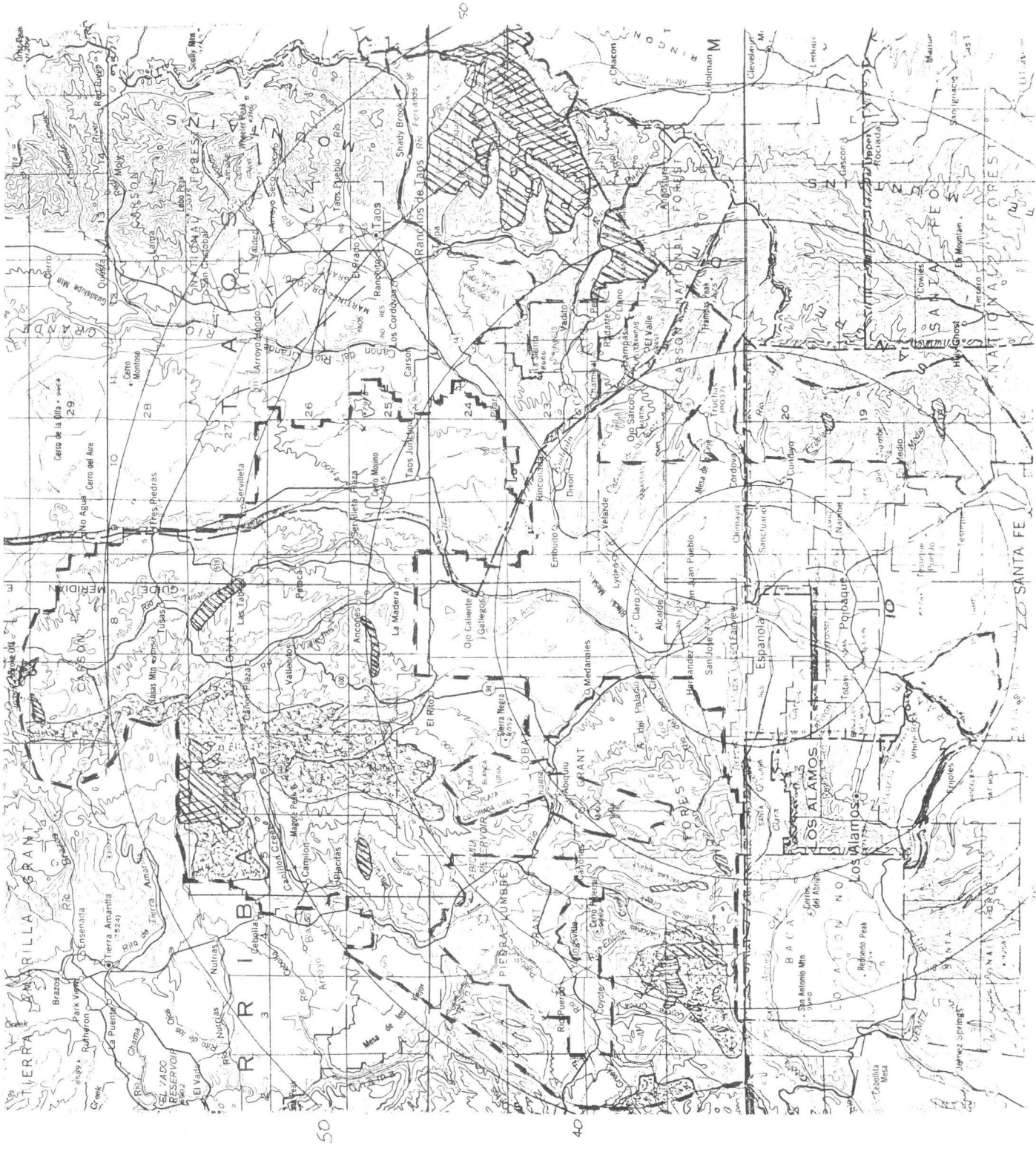

SANTA FE
NATIONAL FOREST
CARSON NATIONAL FOREST
Taos
Ranchos de Taos
Española
Los Alamos
Pojoaque
San Juan Pueblo
Chimayo
Cundiyo
Truchas
Velarde
Embudo
Dixon
Rinconada
Alcalde
Abiquiu
Ojo Caliente
Ojo Sarco
Tres Piedras
Servilleta
Taos Junction
Arroyo Hondo
Cerro Montoso
Cerro del Aire
Lobo Peak
Wheeler Peak
Shady Brook
Rio Pueblo
Rio Grande
Rio Chama
Rio Nutrias
Rio Tusas
Rio Ojo Caliente
Rio Puerco
Rio de Tierra Amarilla
Tierra Amarilla
Ensenada
Park View
Brazos
Rutheron
La Puente
El Vado Reservoir
Nutrias
Tusas
Petaca
Las Tablas
Valdecitos
Camilo Creek
Maggie Peak
Camilo
Placitas
Gallina
Canjilon
Ancones
La Madera
El Rito
Sierra Negra
Medanales
Abiquiu Reservoir
Piedra Lumbre
Coyote
Cerro Negro
Cerro Pedernal
Los Luceros
Rio Arriba
Tierra Amarilla Grant
Piedra Lumbre Grant
Abiquiu Grant
Los Luceros Grant
Baca Location
Redondo Peak
San Antonio Mtn
Jemez Springs
Cerro del Abrigo
Cochiti Mesa
Rio Chama Wilderness
Pedernal Peak
Tres Piedras

Table V-99. Typical Haul to Espanola Mill.

	Distance (Miles)									
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Haul Dist. By Road Type										
Excellent (.39/mi)	3.45	10.35	17.25	24.15	31.05	37.95	44.85	51.75	58.65	65.55
Good (.51/mi)	.85	2.55	4.25	5.95	7.65	9.35	11.05	12.75	14.45	16.15
Fair (.55/mi)	.15	.45	.75	1.05	1.35	1.65	1.95	2.25	2.55	2.85
Poor (1.0/mi)	.55	1.65	2.75	3.85	4.95	6.05	7.15	8.25	9.35	10.45
Average Haul Dist.	5.00	15.00	25.00	35.00	45.00	55.00	65.00	75.00	85.00	95.00
Variable Round Trip Haul Cost ($/mbf)	2.41	7.23	12.06	16.88	21.70	26.53	31.35	36.17	41.00	45.82
Fixed Haul Cost ($/mbf)	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22
Total Haul Cost ($/mbf)	7.63	12.45	17.28	22.10	26.92	31.75	36.57	41.39	46.22	51.04

Road Type

Excellent	69%
Good	17%
Fair	3%
Poor	11%

Table V-100. Delivered Costs: Ponderosa, Espanola Timbershed.

	Distance to the Mill (Miles)					
	0-10	10-20	20-30	30-40	40-50	50-60
Fixed Logging Cost ($/MBF)	64.37	64.37	64.37	64.37	64.37	64.37
Haul Cost ($/MBF)	7.63	12.45	17.28	22.10	26.92	31.75
Avg. Total Cost ($/MBF)	72.00	76.82	81.65	86.47	91.29	96.12
Total Acres (M)	2,010	38,367	53,348	58,464	21,193	9,318
Total Volume	6,626	126,504	175,901	192,768	69,878	30,722
Total Cum. Volume	6,626	133,130	309,031	501,799	571,677	602,399
Total Cost	477,072	9,718,037	14,362,317	16,668,649	6,379,163	2,952,999
Total Cum. Cost	477,072	10,195,109	24,557,426	41,226,075	47,605,238	50,558,236
Avg. Cost ($/MBF)	72.00	76.58	79.47	82.16	83.27	83.93

Table V-101. Ponderosa Pine, Supply Schedule Data, Espanola.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	6,626	477,072			
10	(69,878)		9,718,037	126,504	76.82
10-20	133,130	10,195,109			
20	(221,081)		14,362,317	175,901	81.65
20-30	309,031	24,557,426			
30	(405,415)		16,668,649	192,768	86.47
30-40	501,799	41,226,075			
40	(536,738)		6,379,163	69,878	91.29
40-50	571,677	47,605,238			
50	(587,038)		2,952,999	30,722	96.12
50-60	602,399	50,558,236			

Table V-102. Delivered Costs: Mixed Conifer, Espanola Timbershed.

	Distance to the Mill (Miles)					
	0-10	10-20	20-30	30-40	40-50	50-60
Fixed Logging Cost ($/MBF)	55.42	55.42	55.42	55.42	55.42	55.42
Haul Cost ($/MBF)	7.63	12.45	17.28	22.10	26.92	31.75
Avg. Total Cost ($/MBF)	63.05	67.87	72.70	77.52	82.34	87.17
Total Acres (M)		2,755	43,487	39,654	28,753	5,151
Total Volume	0	10,734	169,412	154,478	112,008	20,069
Total Cum. Volume	0	10,734	180,146	334,624	446,632	466,701
Total Cost	0	728,516	12,316,252	11,975,135	9,222,739	1,749,415
Total Cum. Cost	0	728,516	13,044,768	25,019,903	34,242,642	35,992,057
Avg. Cost ($/MBF)	---	67.87	72.41	74.77	76.67	77.12

Table V-103. Mixed Conifer, Supply Schedule Data, Espanola.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	0	0			
10	(5,367)		728,516	10,734	67.87
10-20	10,734	728,516			
20	(95,440)		12,316,252	169,412	72.70
20-30	180,146	13,044,768			
30	(257,385)		11,975,135	154,478	77.52
30-40	334,624	25,019,903			
40	(390,628)		9,222,739	112,008	82.34
40-50	446,632	34,242,642			
50	(456,667)		1,749,415	20,069	87.17
50-60	466,701	35,992,057			

Table V-104. Delivered Costs: Aggregate, Espanola Timbershed.

	Distance to the Mill (Miles)					
	0-10	10-20	20-30	30-40	40-50	50-60
Total Volume	6,626	137,238	345,313	347,246	181,886	50,791
Total Cum. Volume	6,626	143,864	489,177	836,423	1,018,309	1,069,100
Total Cost	477,072	10,446,522	26,679,442	28,641,666	15,606,975	4,702,659
Total Cum. Cost	477,072	10,923,594	37,603,036	66,244,702	81,851,677	86,554,336
Avg. Cost ($/MBF)	72.00	75.93	76.87	79.20	80.38	80.96

In fact, the procurement costs change by only $1-$2/mbf for each ten-mile increment in distance (Table V-104). This occurs because the costs are based on a weighted average for the timber mix within each respective zone.

The supply schedule is based on marginal cost which uses differences in costs and volumes between zones to calculate a $/mbf figure. In this case there is a different set of "midpoints" involved in the calculations. This makes the $/mbf as a marginal cost different from the average cost per mbf within each zone. In the case here, the $/mbf between each zone is considerably higher than the average $/mbf within the zone (Table V-105).

The supply schedule is fairly linear for ponderosa pine (Figures V-22b and V-23). This reflects the fairly even volume differences between zones up to 40 miles distance from the mill. The mixed conifer type also depicts this distribution in its supply schedule (Figures V-24 and V-25). When the two types are combined the supply schedules change considerably. The cheaper ponderosa pine dominates at the closer distances and allows for a small increase in costs; then when both mixed conifer and ponderosa pine are available, in somewhat equal and large volumes, the curve rises at a steeper rate. Finally, as both volumes become less at the furthest distances, the curve rises steeply for the smaller volume available (Figures V-26 and V-27).

(d) Problems and Opportunities

The mill estimates that procurement costs are approximately 10-15% higher for mixed conifers due to steeper slopes and additional slash. The company feels that stumpage and road costs are too high and that certain skidding distances were too long. They do feel, however, that cable logging has good possibilities and will allow them to reach areas not currently utilized.

Table V-105. Aggregate, Supply Schedule, Espanola

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	6,626	477,072			
10	(75,245)		10,446,522	137,238	76.12
10-20	143,864	10,923,594			
20	(316,521)		26,679,442	345,313	77.26
20-30	489,177	37,603,036			
30	(676,300)		28,641,666	347,246	82.48
30-40	863,423	66,244,702			
40	(940,866)		15,606,975	181,886	85.81
40-50	1,018,309	81,851,677			
50	(1,043,705)		4,702,659	50,791	92.59
50-60	1,069,100	86,554,336			

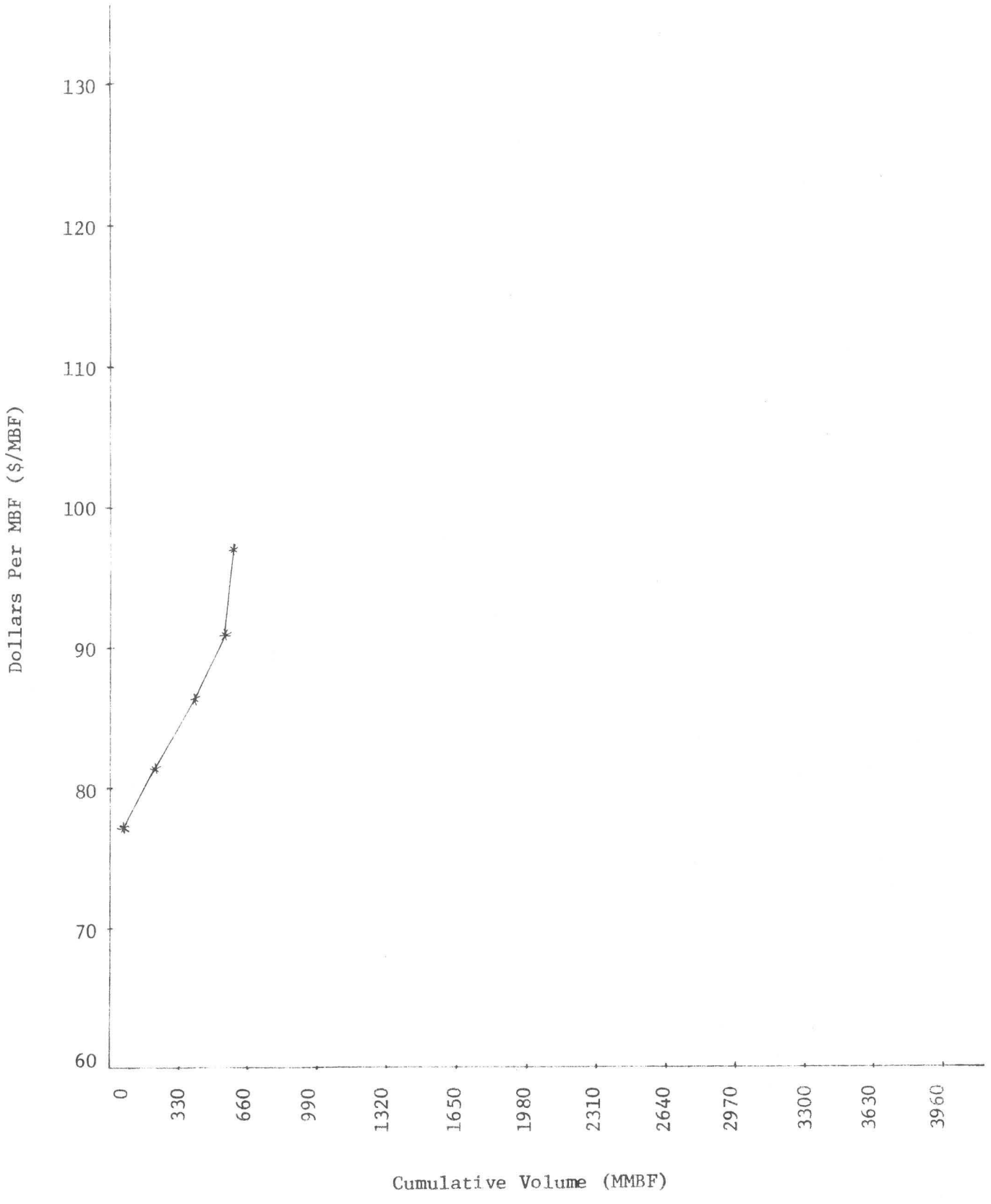


Figure V-22b. Espanola Ponderosa Pine Supply Schedule by Volume.

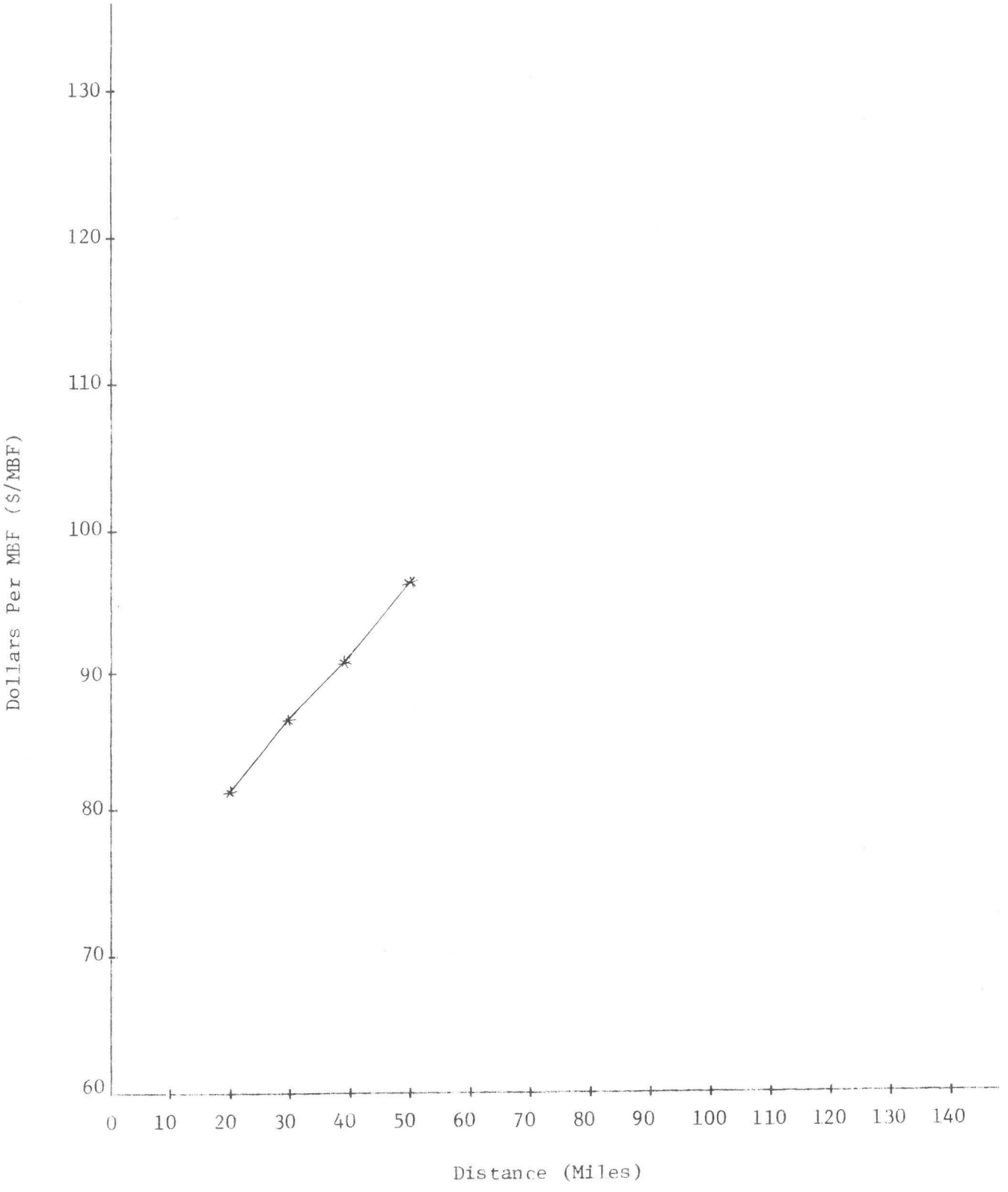


Figure V-23. Espanola Ponderosa Supply Schedule by Distance.

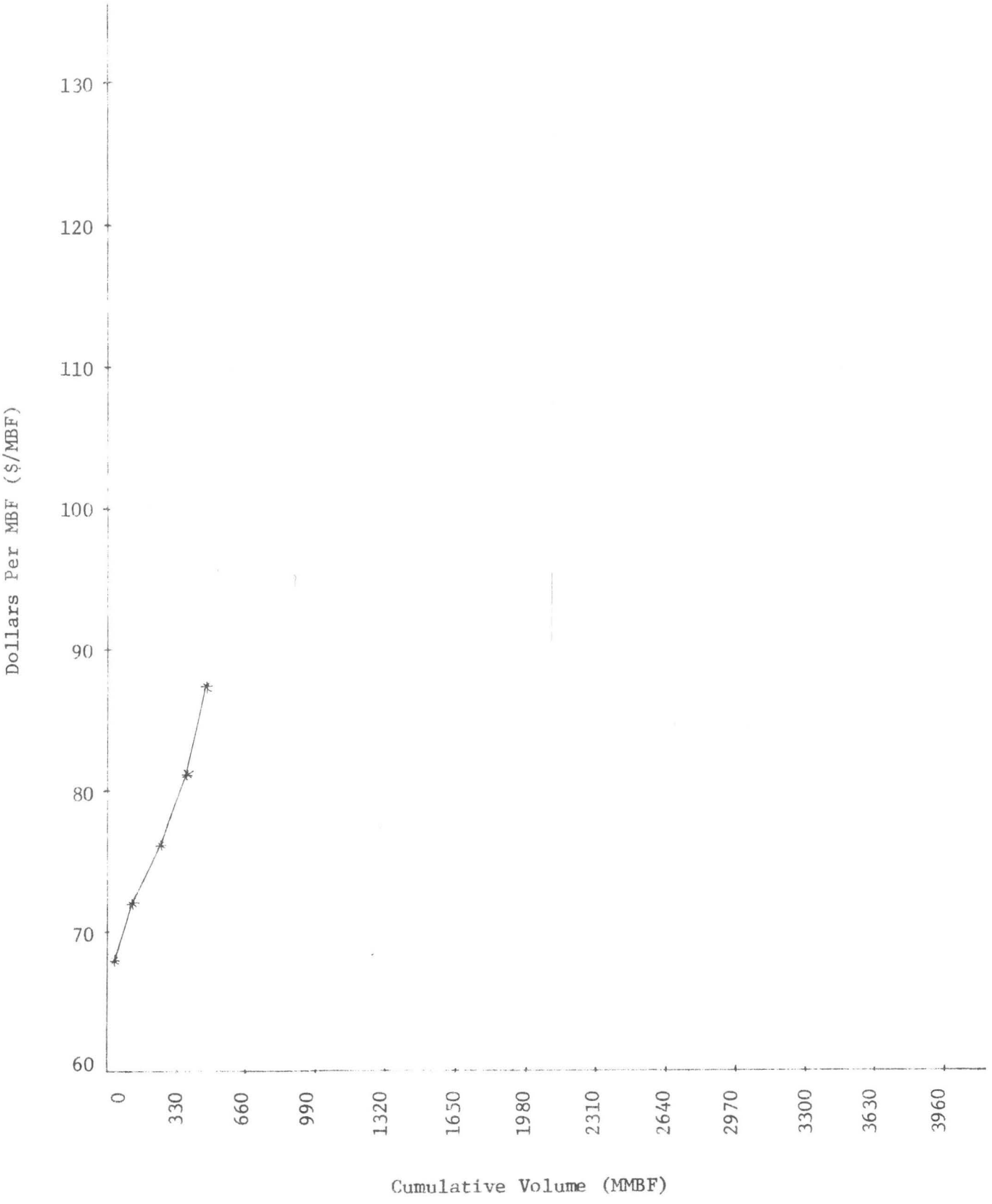


Figure V-24. Espanola Mixed Conifer Supply Schedule by Volume.

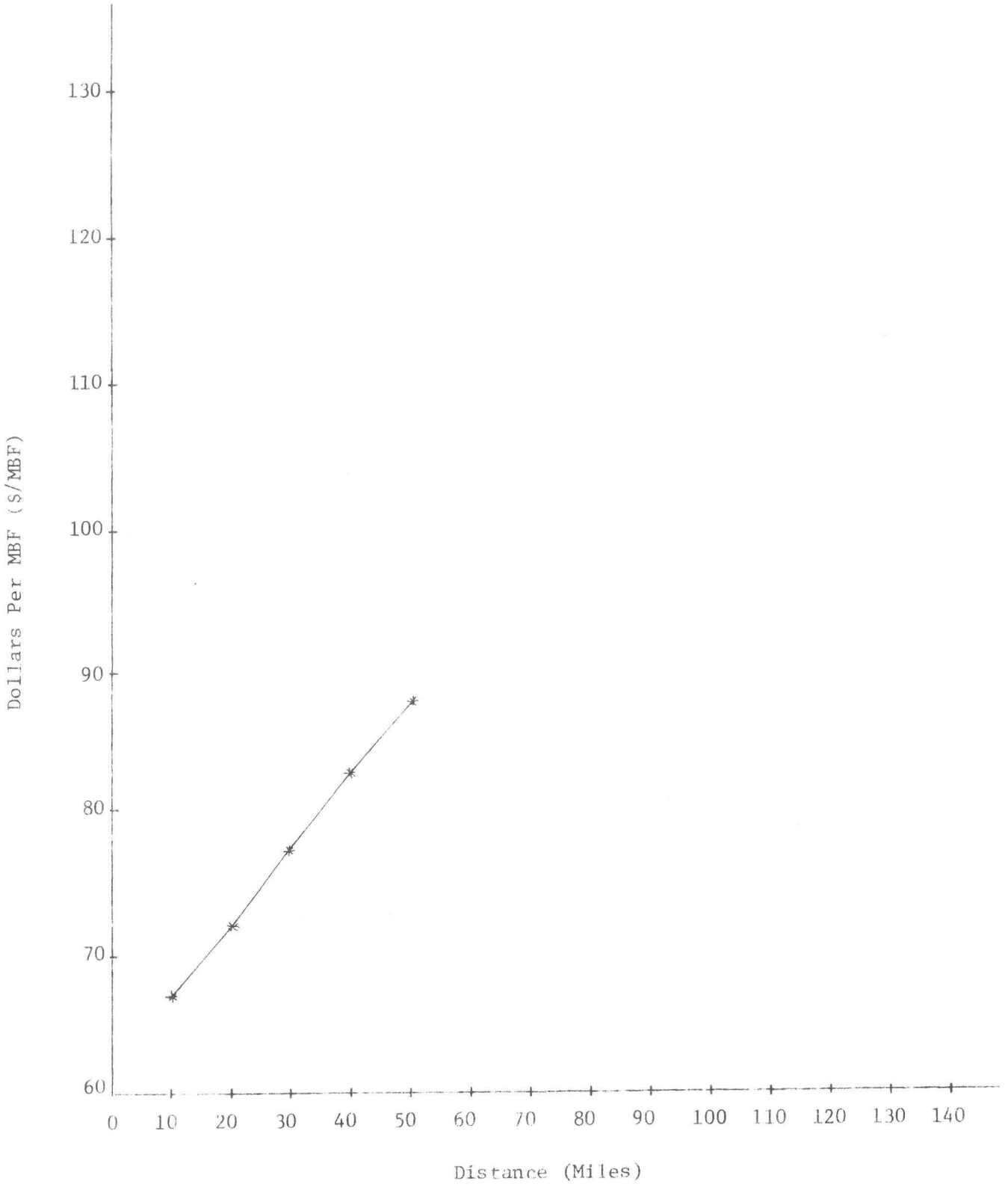


Figure V-25. Espanola Mixed Conifer Supply Schedule by Distance.

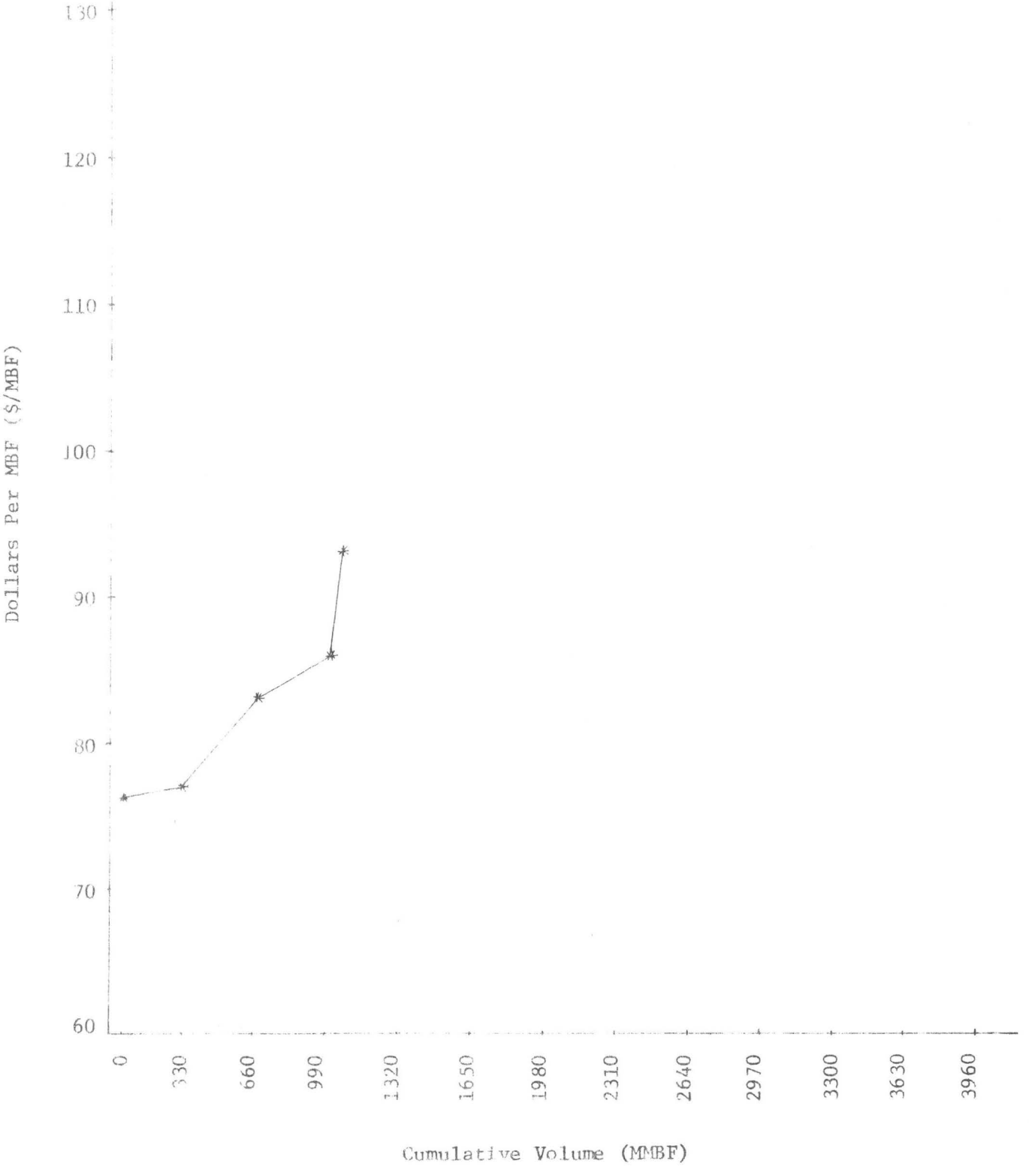


Figure V-26. Espanola Aggregate Supply Schedule by Volume.

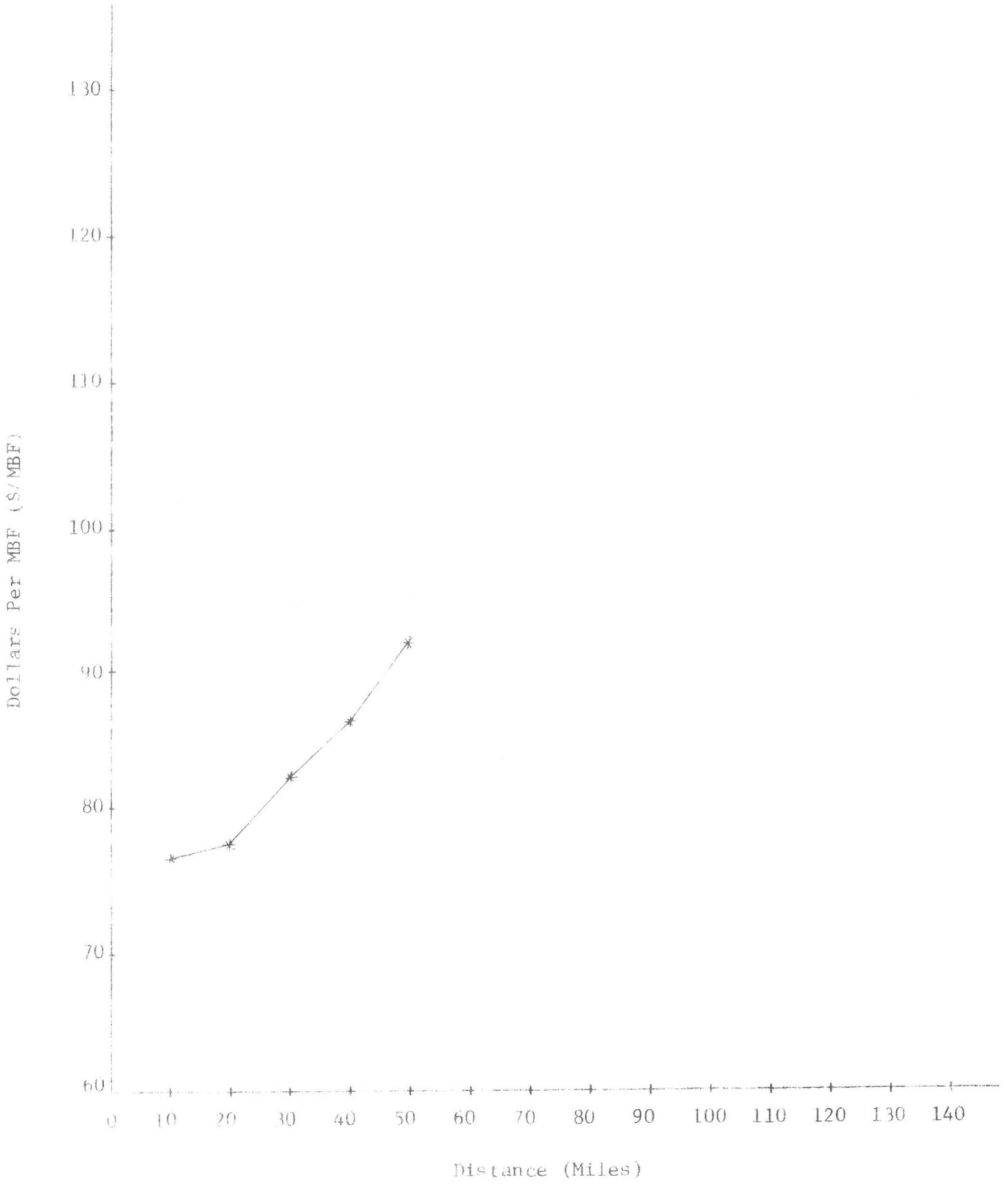


Figure V-27. Espanola Aggregate Supply Schedule by Distance.

The company feels its present product mix is satisfactory. They have no immediate plans to develop new product lines. They feel that their location in the "Sunbelt" will provide more market opportunities in the future.

The Carson National Forest indicates they can expand the use of logging and TSI slash for fuelwood. They hope to stimulate interest in commercial thins for fuelwood use. They say aspen utilization can be measured by producing products such as pallets, excelsior paneling and boards.

The Carson feels that cable logging will increase the acreage of marginal lands available for harvest. Therefore, if cable logging is successful the total Forest allowable cut should increase. The current planning effort is not expected to result in less volumes being made available although the size of sales is likely to decrease.

The Forest believes the mix of timber types on the Carson National Forest makes it difficult to develop silvicultural programs. The Forest has more of a broad array of species than most others in R-3; most Forests have a larger volume and acreage of ponderosa pine.

6. Albuquerque, New Mexico

(a) Mill Characteristics and Wood Product Markets

The Albuquerque timbershed serves as the primary source of raw materials for several mills, most of which are small locally owned operations. The largest mill is owned and operated by the Bates Lumber Company. The Bates' sawmill is located in Albuquerque. This mill has an estimated average annual lumber production of 20,000 mbf. The major species processed are ponderosa pine and Douglas-fir. The major equipment available at the mill includes a debarker, band saw, double cut

band saw, edger, chipper, planer, and kiln. Products produced include lumber, chips, bark mulch, and firewood. Duke City Lumber Company also has a planing and drying facility in Albuquerque. The company's sawmills in Cuba and Espanola send most of their lumber to this facility for drying, planing and/or distribution to markets.

Bates procures all of its raw material from U.S. Forest Service lands. Approximately 70% of this timber is ponderosa pine, 30% is mixed conifer. The mill produces timbers (5%), rough boards (20%), planed boards (65%) and dimension lumber (10%). Almost all of the dimension lumber is made from mixed conifers. Most of the other products utilize ponderosa pine. The mill also produces about 10,000 cubic yards of chips each year and a certain amount of bark shavings. These are sold along with dry sawdust. The shavings are sold to Ponderosa Products. The bark and chips are sold to the pulp and paper mill in Snowflake. The green sawdust is used to operate a dry kiln. Other roundwood residue is sold as fuelwood.

The company markets its products in Arizona, New Mexico, and Texas. Shop, moulding and better grades can be marketed within an 800 mile radius of Albuquerque. Beyond this distance freight rates become prohibitive. Almost all of the lumber is shipped by truck to wholesale distributors.

There is also a particleboard plant in Albuquerque, owned by the Ponderosa Forest Products Company. (They also operate four sawmills in Arizona and New Mexico.) The particleboard plant buys sawmill residues from other mills and also from their own sawmills. They normally use their own mills as a reserve supply. The mill uses 1400 tons of raw material per day. These residues are procured from as far away as

200 miles (<2% of volume is located this far away). They estimate 50% of the final value of particleboard involves procurement/freight costs. The company has no particular species preference. In fact, they prefer a species mix. The main concern is the dryness of the residue. If the residue is wet it is too heavy to haul and use. The particleboard must be 5% or less moisture.

The mill produces 750 pieces of 4' x 8' x 3/8" industrial particleboard each day, 42 mm sq. ft. annually. This is marketed directly to secondary manufacturers such as the furniture industry. The market outlets for the particleboard are principally within the Southwest. Trucks are used almost exclusively to haul the product to markets.

(b) Timbershed Area

Areas of the Sante Fe National Forest included in the Albuquerque timbershed are portions of all Forest Districts except the Cuba and Las Vegas districts. Approximately 160,000 acres of the Coyote District is shared with the other two processing centers, and 118,000 acres of the Espanola District is shared with the Espanola Processing Center. Table V-106 contains the information concerning timbershed characteristics for the Santa Fe National Forest. The majority of the Santa Fe mixed conifer volumes are available in this timbershed.

Table V-107 contains the timber information for the Carson National Forest. The timbershed characteristics for the Carson National Forest are identical to those described for Espanola.

Table V-108 shows the total National Forest acreage and volumes available in the timbershed. Figure V-28 illustrates the timbershed area and various other pertinent characteristics.

Table V-106. Characteristics of the Albuquerque Timbershed, Santa Fe National Forest.

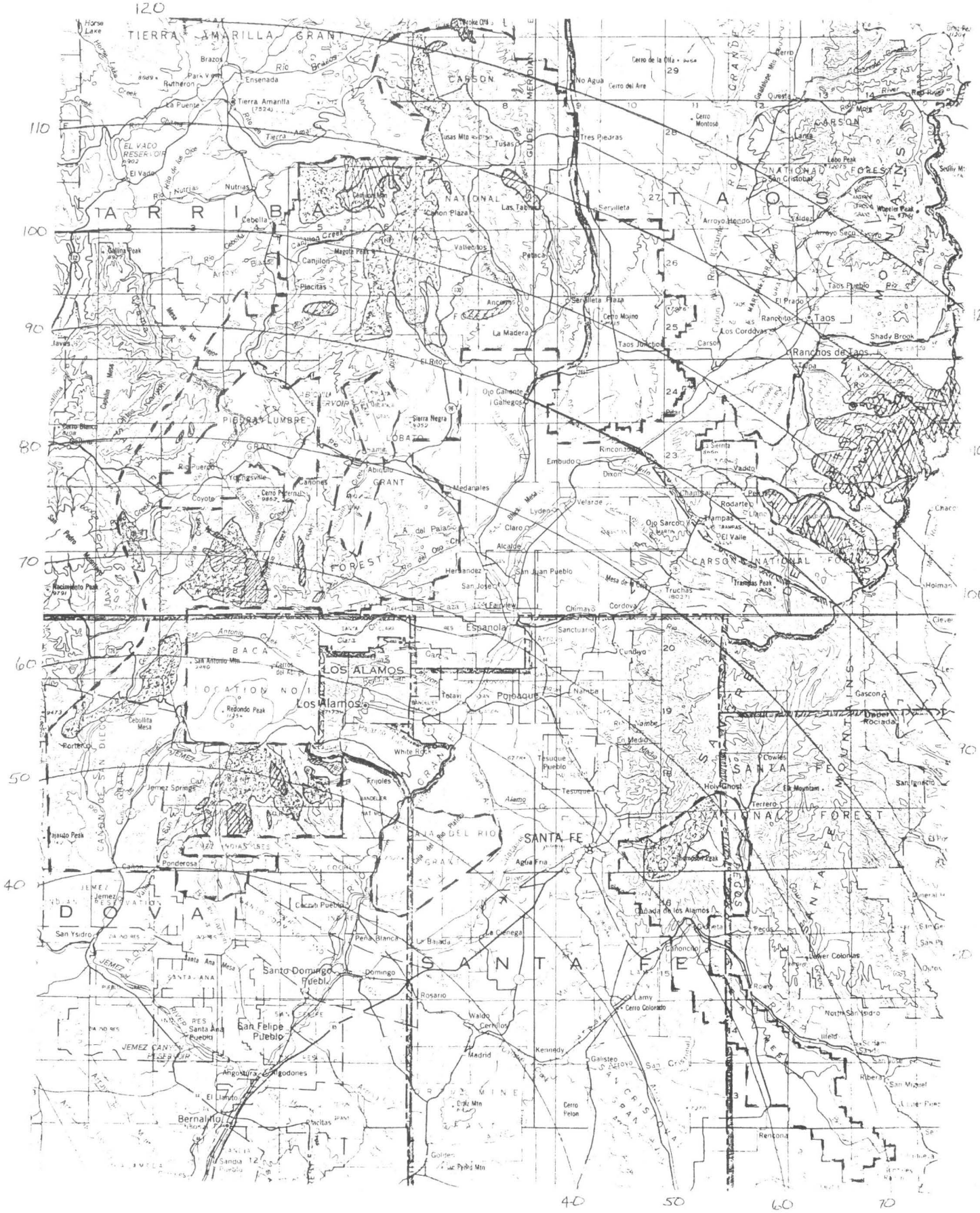
	District										
	Coyote	Percent of District Total Acres	Jemez	Percent of District Total Acres	Pecos	Percent of District Total Acres	Tesque	Percent of District Total Acres	Espanola	Percent of District Total Acres	Timbershed Total
Total Acres (M)	160	64%	173	100%	103	33%	158	75%	118	49%	712
Standard Component Acres (M)	89		63		44		25		36		257
Acres (M) of Standard Component by Species											
Ponderosa Pine	58		42		18		14		23		155
Mixed Conifer	26		20		20		10		9		85
Spruce-fir	5		1		6		1		4		17
Volumes (mmbf) of Standard Component											
Ponderosa Pine	191		139		59		46		76		511
Mixed Conifer	101		78		78		39		35		311
Spruce-fir	29		6		35		6		23		99

Table V-107. Timbershed Characteristics, Albuquerque Timbershed, Carson National Forest.

	Acres (M)	Volume (MMBF)
Total Standard Component	257.9	946.7
Ponderosa Pine	87.7	289.4
Mixed Conifer	74.8	291.7
Spruce-Fir	58.0	336.4

Table V-108. Total Acreage and Volumes Available, Albuquerque Timbershed, Standard Components, Sawtimber.

	Acres (M)	Volume (MMBF)
Total Standard Component	514.9	1,867.7
Ponderosa Pine	242.7	800.4
Mixed Conifer	159.8	602.7
Spruce Fir	75.0	435.4


TIERRA AMARILLA GRANT
CARSON
TARRIBA
NATIONAL
Canon Plaza
Las Tablas
Servilleta
Arroyo Hondo
TAOS
Taos Pueblo
El Prado
Taos
Ranchos de Taos
Shady Brook
Los Corddvas
Taos Junction
La Madera
Petaca
Vallecitos
Ancones
Servilleta Plaza
Cerro Molino
Rinconada
Embudo
Dixon
Vadito
Chamisal
Rodarte
Llano
Tampas
El Valle
Ojo Sarco
Velarde
Lyden
Claro
Alcalde
Hernandez
San Juan Pueblo
San Jose
Fairview
Chimayo
Cordova
Truchas
Trampas Peak
CARSON NATIONAL FOREST
PIEDRA LUMBRE
LOBATO
Ojo Caliente
Gallegos
Sierra Negra
Abiquiu
GRANT
Medanales
Canones
Coyote
Youngsville
Rio Puerco
Cerro Pedernal
Cerro Blanco
Javas
Mesa de los Viejos
Capulin Mesa
Canjilon
Placitas
Magote Peak
Gallina Peak
Nutrias
Rio Nutrias
El Vado
El Vado Reservoir
Rio de los Pinos
Tierra Amarilla
Rutheron
Park View
Brazos
Ensenada
La Puente
Rio Brazos
Horse Lake
Tusas Mtn
Tusas
Tres Piedras
Cerro Montoso
Cerro del Aire
No Agua
Cerro de la Olla
Questa
Rio Hondo
Lama
Lobo Peak
San Cristobal
Wheeler Peak
Arroyo Seco
Rio Grande del Rancho
Rio Grande del Norte
Rio Grande Gorge
Guadalupe Mtn
Rio Pueblo de Taos
Rio Lucero
Rio Chiquito
Rio Hondo
Rio Fernando de Taos
Rio Grande
Rio Ojo Caliente
Rio Chama
Rio Gallina
Rio Arriba
Rio Puerco
Rio Puerco de Chama
Rio Cebolla
Rio Gallina
Rio Vallecitos
Rio Tusas
Rio Ojo de los Pinos
Rio Tierra Amarilla
Rio Brazos
Rio Chama
Rio Ojo Caliente

(c) Supply Schedules

The Albuquerque timbershed has, by far, the longest hauling distances of any of the processing centers considered in this study. The closest timber is 30 miles distance from the mill. The mill hauls logs up to 130 miles, one-way trip (Table V-109).

The timber volumes are fairly evenly distributed from 40 to 130 miles. However, the largest amounts are located in the 100 to 130 mile range. There is somewhat of a gap in timber volumes in the 70 to 90 mile range, particularly regarding the mixed conifer type (Table V-109)

The road system is defined as "excellent" for almost 90% of the haul. This is because a large portion of the haul involves traveling over interstate roads to get to the timber resource. To a certain degree this helps to defray the costs; however, in total, the high mileage results in significant costs. The hauling costs per mbf alone at longer distances, 90 miles plus, are close to the total procurement costs per mbf for certain other timbersheds (Table V-110).

The supply schedule for ponderosa pine is fairly linear for both volumes and distance (Tables V-111 and V-112, and Figures V-29 and V-30). This reflects the fairly even distribution of pine volumes in the timbershed.

The mixed conifer supply schedule is somewhat different. The volumes in each zone are more diverse than the ponderosa pine (Tables V-113 and V-114). This situation creates a more erratic supply schedule. Costs rise rapidly in the 60 to 80 mile range because of significantly less volumes being available. This increased rate then declines as greater volumes become available within the 80 to 110 miles zones. Figures V-31 and V-32 illustrate the supply schedule graphs.

Table V-109. Albuquerque Timbershed, Acreage and Volume Distribution.

Distance	ACRES				VOLUME (MBF)			
	Ponderosa	MC	SF	Total	Ponderosa	MC	SF	Total
0-10	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0
20-30	0	0	0	0	0	0	0	0
30-40	2,427	0	0	2,427	8,004	0	0	8,004
40-50	26,697	15,181	0	41,878	88,044	57,257	0	145,301
50-60	24,270	18,377	0	42,647	80,040	69,310	0	149,350
60-70	31,551	35,156	0	66,707	104,052	132,594	0	236,646
70-80	26,697	6,392	0	33,089	88,044	24,108	0	112,152
80-90	21,843	0	0	21,843	72,036	0	0	72,036
90-100	41,259	33,558	6,750	81,567	136,068	126,567	39,186	301,821
100-110	38,832	41,548	53,250	133,630	128,064	156,702	309,134	593,900
110-120	24,270	9,268	14,250	47,788	80,040	34,957	82,726	197,723
120-130	4,854	320	750	5,924	16,008	1,205	4,354	21,567
	242,700	159,800	75,000	477,500	800,400	602,700	435,400	1,838,500

Table V-110. Typical Haul to Albuquerque Mill.

	Distance (Miles)													
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130	130-140
Haul Dist. By Road Type														
Excellent (.39/mi)	4.45	13.35	22.25	31.15	40.05	48.95	57.85	66.75	75.65	84.55	93.45	102.35	111.25	120.15
Good (.51/mi)	.35	1.05	1.75	2.45	3.15	3.85	4.55	5.25	5.95	6.65	7.35	8.05	8.75	9.45
Fair (.55/mi)	.05	.15	.25	.35	.45	.55	.65	.75	.85	.95	1.05	1.15	1.25	1.35
Poor (1.0/mi)	.15	.45	.75	1.05	1.35	1.65	1.95	2.25	2.55	2.85	3.15	3.45	3.75	4.05
Average Haul Dist.	5.0	15.0	25.0	35.0	45.0	55.0	65.0	75.0	85.0	95.0	105.0	115.0	125.0	135.0
Variable Round Trip Haul Cost ($/mbf)	2.09	6.27	10.46	14.64	18.82	23.01	27.19	31.37	35.55	39.74	43.88	48.11	52.29	56.47
Fixed Haul Cost ($/mbf)	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22
Total Haul Cost ($/mbf)	7.31	11.49	15.68	19.86	24.04	28.23	32.41	36.59	40.77	44.96	49.10	53.33	57.51	61.69

Road Type

Excellent	89%
Good	7%
Fair	1%
Poor	3%

Table V-111. Delivered Costs: Ponderosa Pine, Albuquerque Timbershed.

	Distance to the Mill (miles)									
	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130
Fixed Logging Cost ($/mbf)	64.37	64.37	64.37	64.37	64.37	64.37	64.37	64.37	64.37	64.37
Haul Cost ($/mbf)	19.86	24.04	28.32	32.41	36.59	40.77	44.96	49.10	53.33	57.51
Avg. Total Cost ($/mbf)	84.23	88.41	92.60	96.78	100.96	105.14	109.33	113.47	117.70	121.88
Total Volume	8,004	88,044	80,040	104,052	88,044	72,036	136,068	128,064	80,040	16,008
Total Cum. Volume	8,004	96,048	176,088	280,140	368,184	440,220	576,288	704,352	784,392	800,400
Total Cost	674,177	7,783,970	7,411,704	10,070,153	8,888,922	7,573,865	14,876,314	14,531,422	9,420,708	1,951,055
Total Cum. Cost	674,177	8,458,147	15,869,851	25,940,004	34,828,926	42,402,791	57,279,105	71,810,527	81,231,235	83,182,290
Avg. Cost ($/mbf)	84.23	88.06	90.12	92.60	94.60	96.32	99.39	101.95	103.56	103.93

Table V-112. Ponderosa Pine, Supply Schedule Data, Albuquerque Timbershed.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
30-40	8,004	674,177			
40	(52,026)		7,783,970	88,044	88.41
40-50	96,048	8,458,147			
50	(136,068)		7,411,704	80,040	92.60
50-60	176,088	15,869,851			
60	(228,114)		10,070,153	104,052	96.78
60-70	280,140	25,940,004			
70	(324,162)		8,888,922	88,044	100.96
70-80	368,184	34,828,926			
80	(404,202)		7,573,865	72,036	105.14
80-90	440,220	42,402,791			
90	(508,254)		14,876,314	136,068	109.33
90-100	576,288	57,279,105			
100	(640,320)		14,531,422	128,064	113.47
100-110	704,352	71,810,527			
110	(744,372)		9,420,708	80,040	117.70
110-120	784,392	81,231,235			
120	(792,396)		1,951,055	16,008	121.88
120-130	800,400	83,182,290			

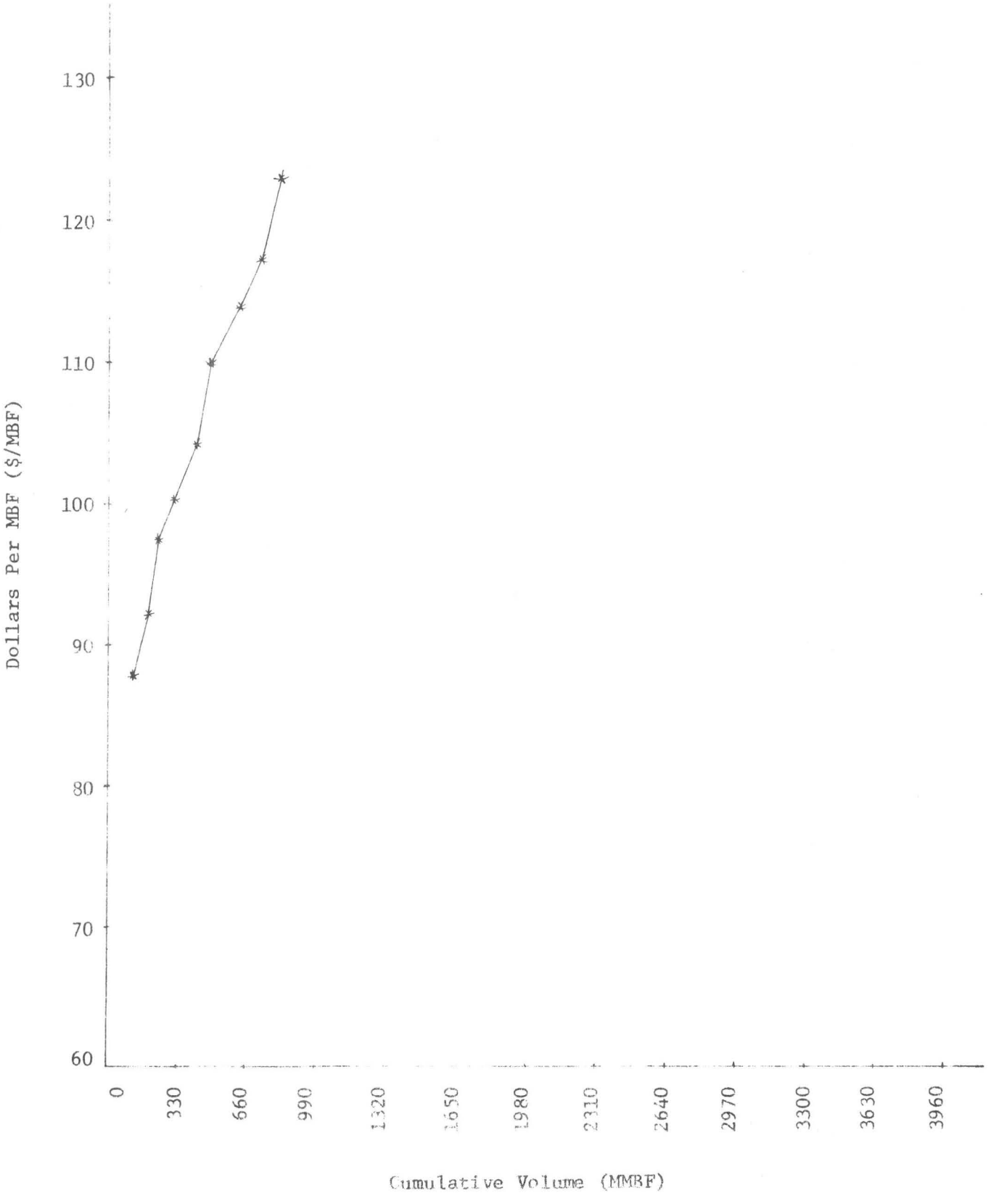


Figure V-29. Albuquerque Ponderosa Pine Supply Schedule by Volume.

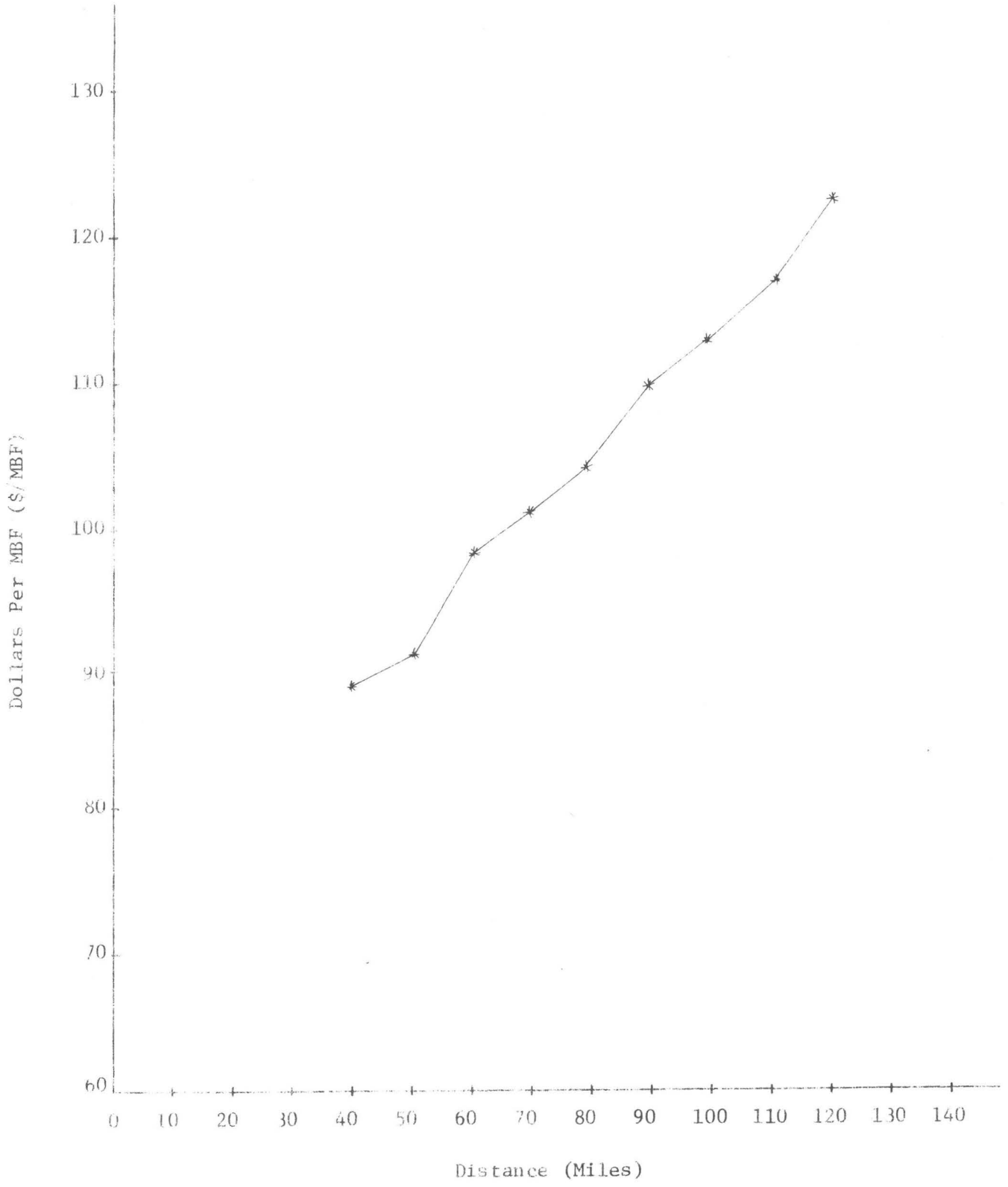


Figure V-30. Albuquerque Ponderosa Pine Supply Schedule by Distance.

Table V-113. Delivered Costs: Mixed Conifer, Albuquerque Timbershed.

	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130
Fixed Logging Cost ($/mbf)	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42	55.42
Haul Cost ($/mbf)	24.04	28.23	32.41	36.59	40.77	44.96	49.10	53.33	57.51
Avg. Total Cost ($/mbf)	79.46	83.65	87.83	92.01	96.19	100.38	104.52	108.95	112.93
Total Volume	57,257	69,310	132,594	24,108		126,567	156,702	34,957	1,205
Total Cum. Volume	57,257	126,567	259,161	283,269	283,269	409,836	566,538	601,495	602,700
Total Cost	4,549,641	5,797,782	11,645,731	2,218,177		12,704,795	16,378,493	3,808,565	136,081
Total Cum. Cost	4,549,641	10,347,423	21,993,154	24,211,331	24,211,331	36,916,126	53,294,619	57,103,184	57,239,265
Avg. Cost ($/mbf)	79.46	81.75	84.86	85.47	85.47	90.08	94.07	94.94	94.97

Table V-114. Mixed Conifer, Supply Schedule Data, Albuquerque Timbershed.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
40-50	57,257	4,549,641			
50	(91,912)		5,797,782	69,310	83.65
50-60	126,567	10,347,423			
60	(192,864)		11,645,731	132,594	87.83
60-70	259,161	21,993,154			
70	(271,215)		2,218,177	24,108	92.01
70-80	283,269	24,211,331			
80	(283,269)		0	0	--
80-90	283,269	24,211,331			
90	(346,553)		12,704,795	126,567	100.38
90-100	409,836	36,916,126			
100	(488,187)		16,378,493	156,702	104.52
100-110	566,538	53,294,619			
110	(584,017)		3,808,565	34,957	108.95
110-120	601,495	57,103,184			
120	(602,098)		136,081	1,205	112.93
120-130	602,700	57,239,265			

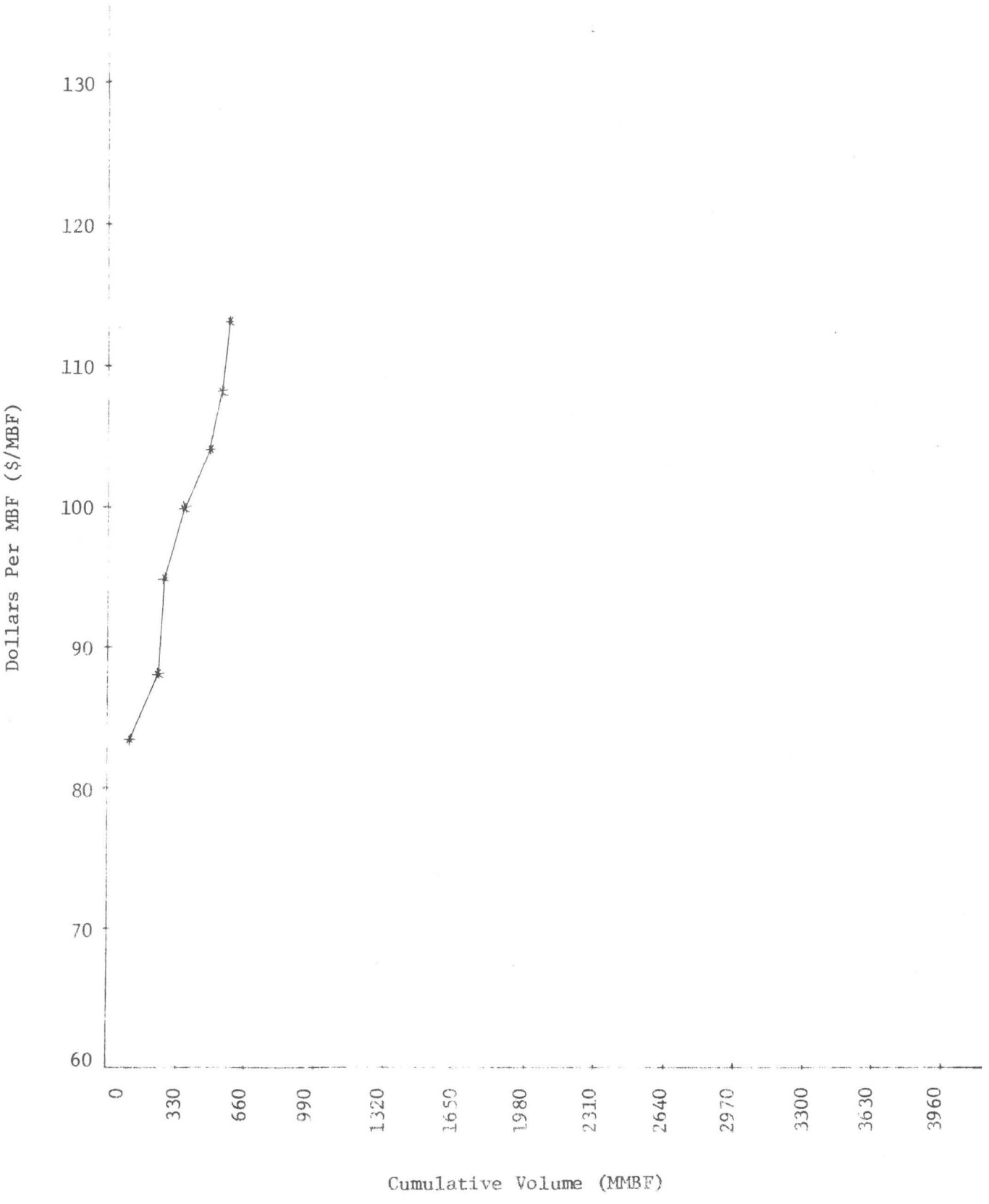


Figure V-31. Albuquerque Mixed Conifer Supply Schedule by Volume.

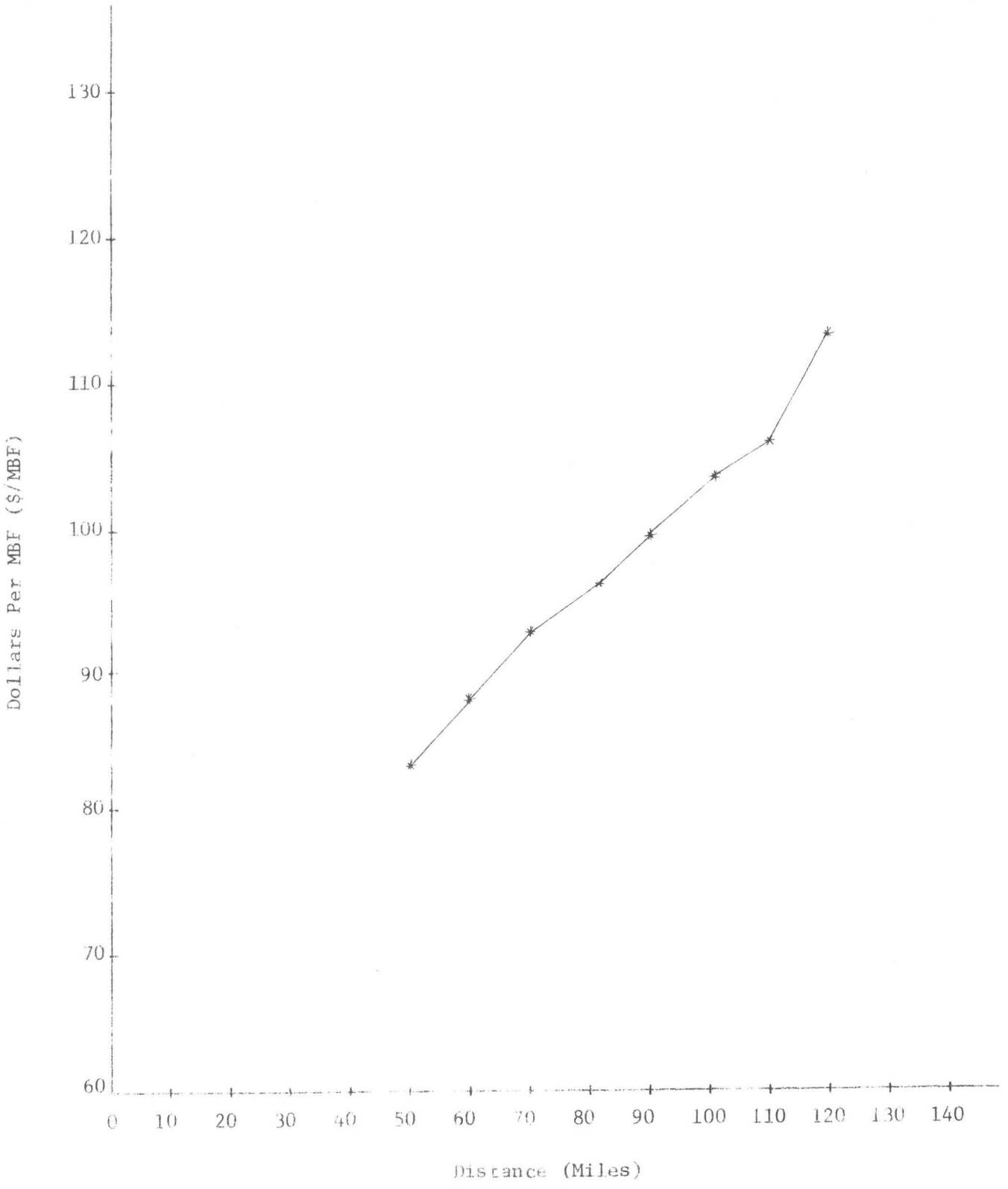


Figure V-32. Albuquerque Mixed Conifer Supply Schedule by Distance.

The aggregate schedule is particularly interesting. The supply schedule rises, then remains relatively constant for cumulative volumes from about 600 mmbf to 1100 mbf (Figures V-33 and V-34). This occurs because cheaper mixed conifers combined with the ponderosa pine volumes tend to offset the added haul costs (compared to volume mixes closer to the mill) (Tables V-115 and V-116). This volume/species mix creates a more favorable $/mbf situation and, in part, is why the mill can afford to haul logs such long distances.

(d) Problems and Opportunities

The mills feel there is strong competition from British Columbia regarding dimension common lumber and particleboard. At the same time they feel their market location is a benefit and the large volume of ponderosa pine is a favorable asset. The fact that Ponderosa Products is the only particleboard plant in the vicinity is also an advantage to that mill.

The timbershed includes a mix of species types. There is a more even distribution of volumes here than in some other timbersheds. This has definite implications regarding wood product mix possibilities. In general, a more diversified product line would be necessary to properly utilize the raw material.

In the mills' opinion there are no added costs in mixed conifer harvest as the volumes per acre are higher than for ponderosa pine and offset other additional costs. In this analysis, using appraisal data, it was found that mixed conifers are somewhat cheaper than the ponderosa pine. This fact combined with the volume distribution for the timbershed creates a favorable supply situation. A large amount of volume is available at relatively the same cost.

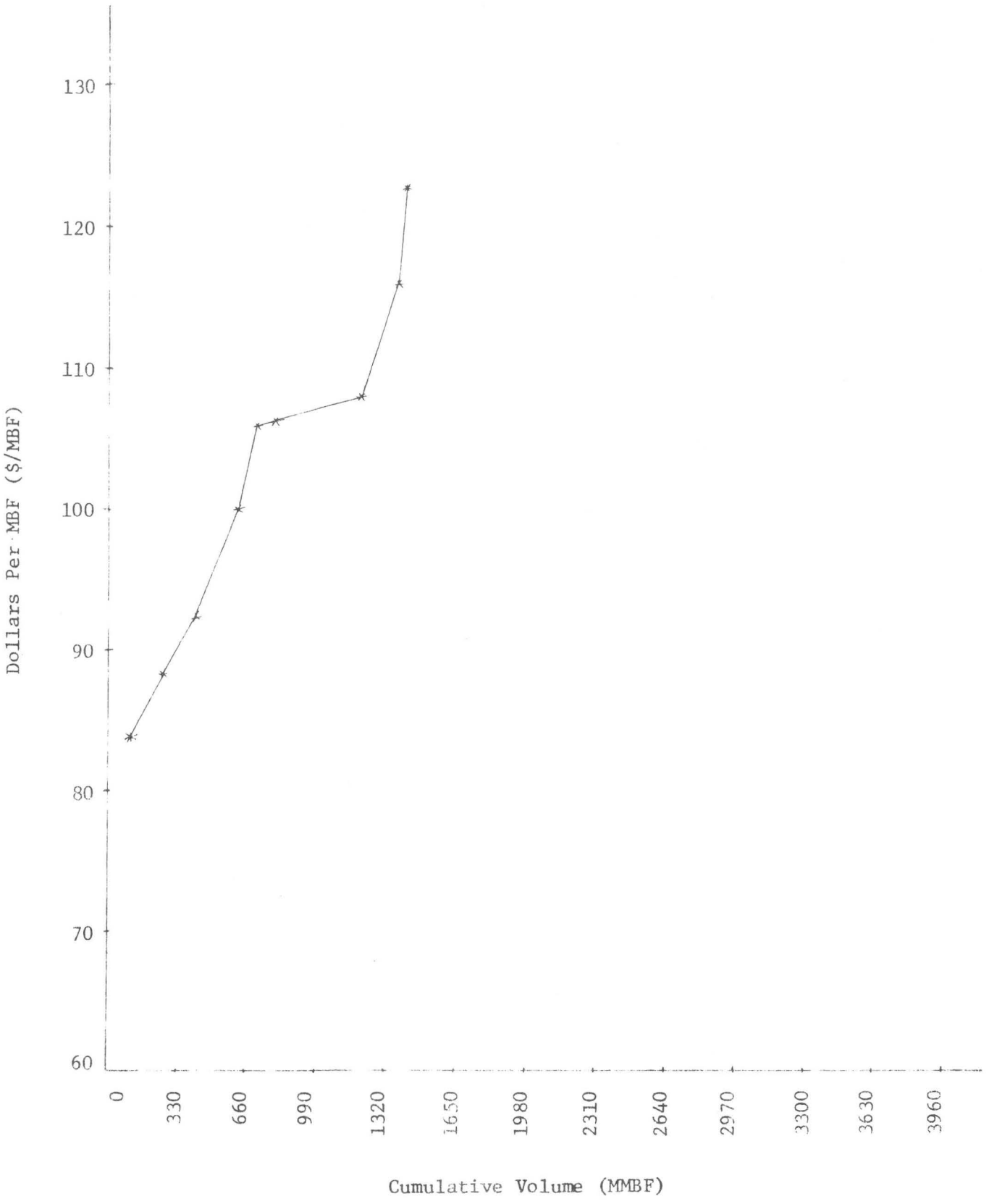


Figure V-33. Albuquerque Aggregate Supply Schedule by Volume.

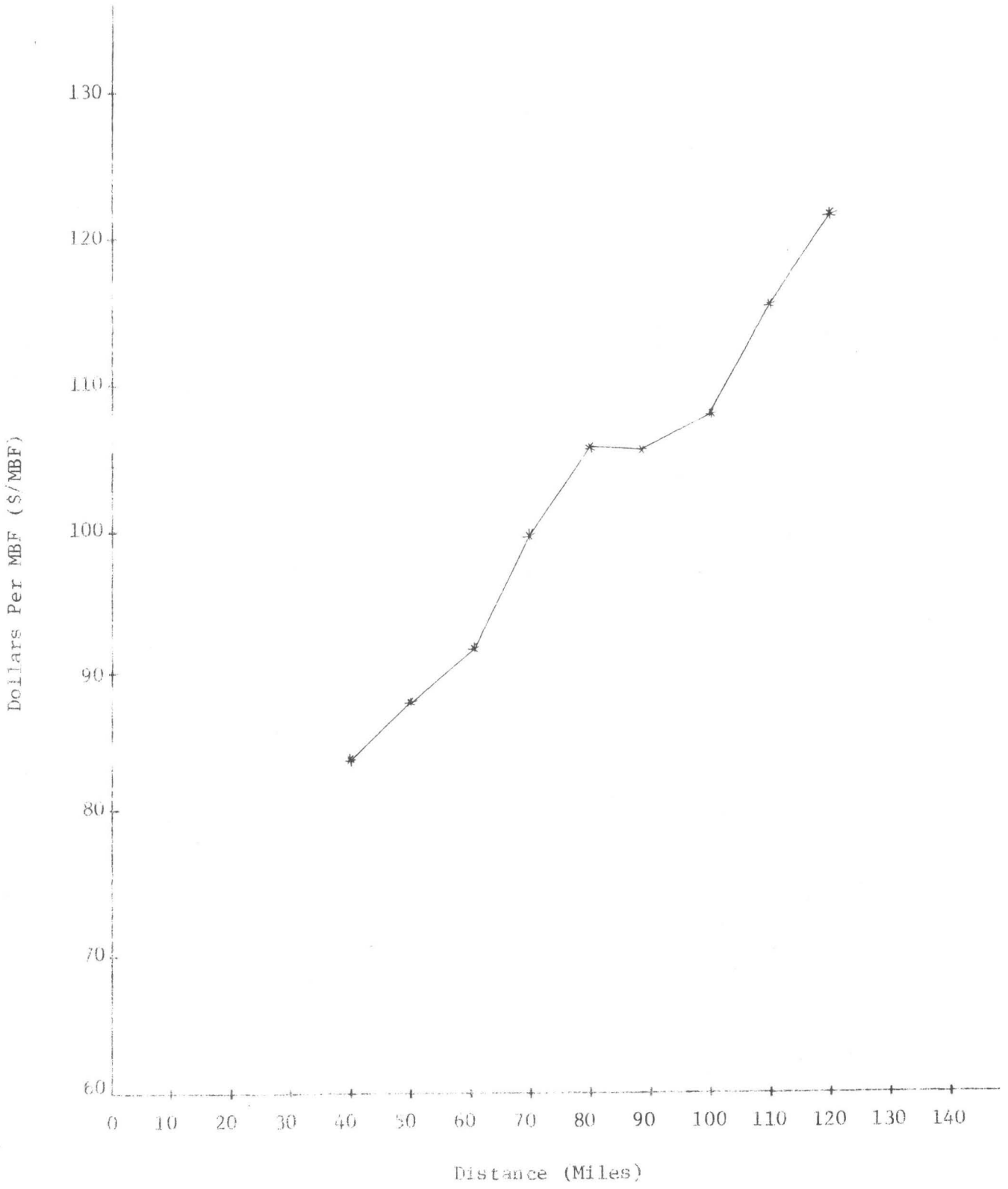


Figure V-34. Albuquerque Aggregate Supply Schedule by Distance.

Table V-115. Delivered Costs: Aggregate, Albuquerque Timbershed.

	Distance to the Mill (Miles)									
	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120-130
Haul Cost ($/mbf)	19.86	24.04	28.23	32.41	36.59	40.77	44.96	49.10	53.33	57.51
Total Volume	8,004	145,301	149,350	236,646	112,152	72,036	262,635	284,766	114,997	17,213
Total Cum. Volume	8,004	153,305	302,655	539,301	651,453	723,489	986,124	1,270,890	1,385,887	1,403,100
Total Cost	674,177	12,333,611	13,209,486	21,715,934	11,107,099	7,573,865	27,589,109	30,909,915	13,229,273	2,087,136
Total Cum. Cost	674,177	13,007,788	26,217,274	47,933,208	59,040,307	66,614,172	94,203,281	125,113,196	138,342,469	140,429,605
Avg. Cost ($/mbf)	84.23	84.85	86.62	88.88	90.63	92.07	95.53	98.45	99.82	100.09

Table V-116. Aggregate, Supply Schedule Data, Albuquerque Timbershed.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
30-40	8,004	674,177			
40	(80,655)		12,333,611	145,301	84.88
40-50	153,305	13,007,788			
50	(227,980)		13,209,486	149,350	88.45
50-60	302,655	26,217,274			
60	(420,978)		21,715,934	236,646	91.77
60-70	539,301	47,933,208			
70	(595,377)		11,107,099	112,152	99.04
70-80	651,453	59,040,307			
80	(687,471)		7,573,865	72,036	105.14
80-90	723,489	66,614,172			
90	(854,807)		27,589,109	262,635	105.05
90-100	986,124	94,203,281			
100	(1,128,507)		30,909,915	284,766	108.54
100-110	1,270,890	125,113,196			
110	(1,328,389)		13,229,273	114,997	115.04
110-120	1,385,887	138,342,469			
120	(1,394,494)		2,087,136	17,213	121.25
120-130	1,403,100	140,429,605			

7. Cuba, New Mexico

(a) Mill Characteristics and Wood Product Markets

The Cuba timbershed supplies the timber for the Duke City Lumber Company's mill located in Cuba, New Mexico. The mill has an estimated annual production of 25,000 mbf and manufactures lumber and chips from ponderosa pine, Douglas-fir and white fir. Equipment utilized includes a debarker, band saw, gang saw, chipper, and planer.

The mill obtains virtually all its raw material (except for Vermilio Park) from the U.S. Forest Service. Roughly 15% of this material is mixed conifer, the other 85% ponderosa pine. The majority of the ponderosa pine is used to produce shop and better (25%), roughboards (25%), and dimension lumber (50%). The bulk of the mixed conifers (75%) are used for dimension lumber, mostly sold for framing material. The remainder is used for rough board. The chips (120 mcf/month) are sent to Snowflake, Arizona when economically feasible. If economical, the shavings and dry sawdust are sent to the Ponderosa Products particleboard plant in Albuquerque; otherwise these by-products are burned as waste. The company believes there may be an opportunity to use these residues instead in the drying process. Bark is sold at cost f.o.b. the mill. The mill sends a large portion of its lumber to Albuquerque to be planed and/or dried at the company's distribution yard located there.

The company markets its products by truck (80%) mostly to cities in Texas, New Mexico, and Arizona. The moulding lumber is shipped to markets in the Midwest and in New York State by rail. About 80% of the products sold are sold retail by the Albuquerque distribution yard, the rest, wholesale.

From a profit standpoint, moulding is the best product. Ponderosa pine (except for lower grade dimension ponderosa pine) brings about

$50 more per mbf than mixed conifer lumber. The white fir, spruce and ponderosa pine are dried to approximately 19%. Upper grades are dried to 12% or less. The Douglas-fir is sold green. At one time the company tried to separate the Douglas-fir logs by grade to make various mouldings. They felt this was too costly and have discontinued the effort.

(b) Timbershed Area

The mill procures timber from the west side of the Santa Fe National Forest. Areas of the Sante Fe occupied by the Cuba timbershed include the entire Cuba Ranger District (approximately 243,000 acres) and approximately 250,000 of the Coyote Ranger District. Of the 250,000 acres on the Coyote District, 160,000 acres are also shared with the Albuquerque and Espanola timbersheds. Table V-117 contains the timbershed characteristics based on the portions of the timbershed on the Santa Fe National Forest. Figure V-35 shows various characteristics of the timbershed.

(c) Supply Schedules

The Cuba timbershed represents a homogeneous distribution of timber, more so than some other timbersheds in the two states. In particular, mixed conifers are fairly evenly distributed between distance zones. Ponderosa pine is also fairly evenly distributed, although most of the volumes occur within a 20 to 30 mile distance from the processing center (Tables V-118 and V-119).

Procurement costs per mbf for timbered areas equidistant from the mill are slightly higher for ponderosa pine. Overall the procurement costs are less for mixed conifer in that the type occurs closer to the mill. The mixed conifer type is within 30 miles of the mill, the

Table V-117. Characteristics of the Cuba Timbershed, Santa Fe National Forest (only forest involved).

	District				
	Coyote	Percent of District Total Acres	Cuba	Percent of District Total Acres	Timbershed Total
Total Acres (M)	250	100%	243	100%	493
Standard Component Acres (M)	89		89		178
Acres (M) of Standard Component by Species					
Ponderosa Pine	58		69		127
Mixed Conifer	26		17		43
Spruce-fir	5		3		8
Volumes (mmbf) of Standard Component					
Ponderosa Pine	293.7		227.7		521.4
Mixed Conifer	101.4		66.3		167.7
Spruce-fir	29.0		17.4		46.4

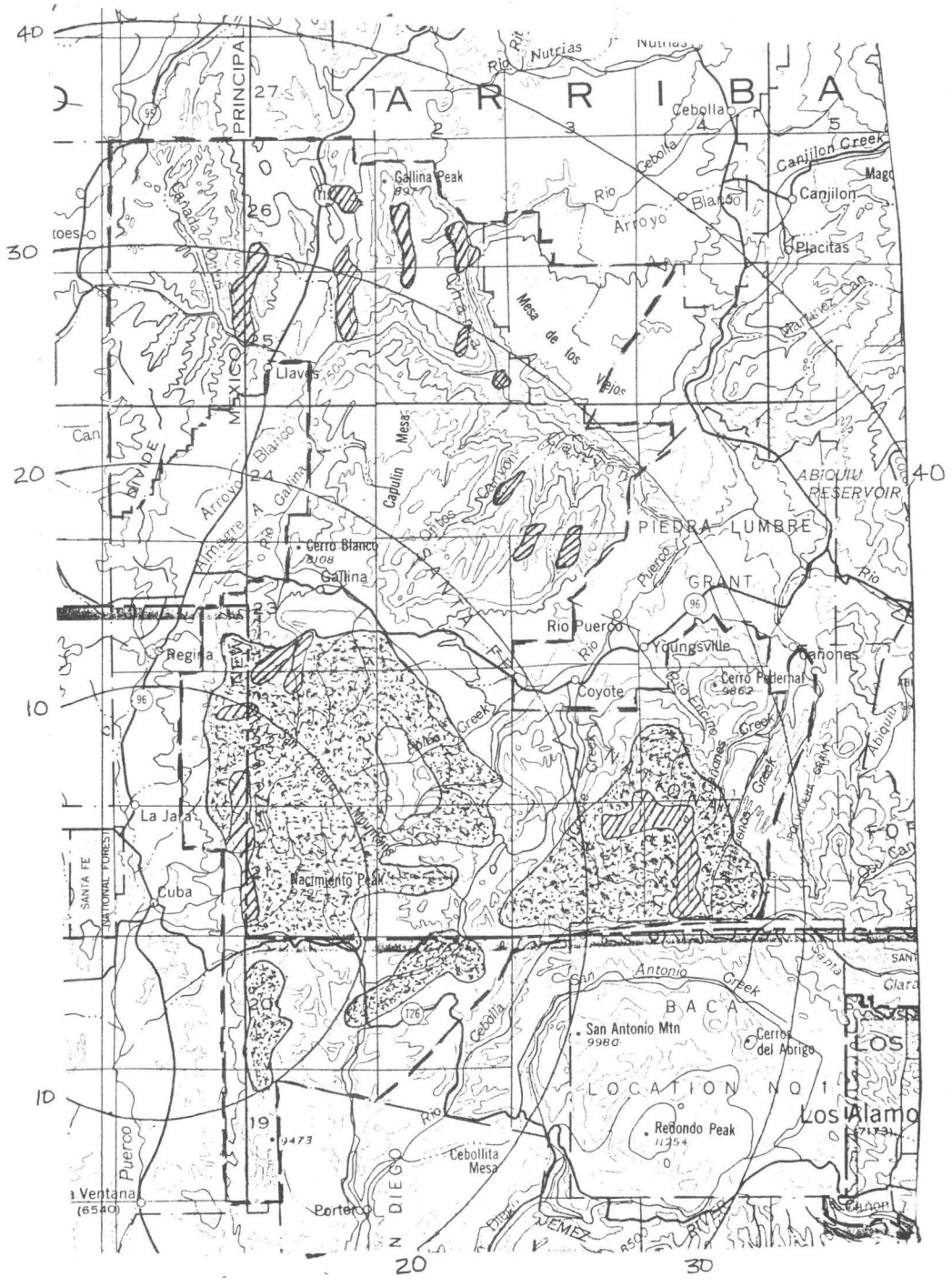


Figure V-35. Timbershed Characteristics, Cuba Processing Center.

Table V-118. Delivered Costs: Ponderosa, Cuba Timbershed.

	Distance to the Mill (Miles)			
	0-10	10-20	20-30	30-40
Fixed Logging Cost ($/MBF)	64.37	64.37	64.37	64.37
Haul Cost ($/MBF)	8.27	14.37	20.47	26.57
Avg. Total Cost ($/MBF)	72.64	78.74	84.84	90.94
Total Acres (M)	8,001	30,480	61,722	26,797
Total Volume	32,848	125,136	253,400	110,016
Total Cum. Volume	32,848	157,984	411,384	521,400
Total Cost	2,386,079	9,853,209	21,498,456	10,004,855
Total Cum. Cost	2,386,079	12,239,287	33,737,743	43,742,598
Avg. Cost ($/MBF)	72.64	77.47	82.01	83.89

Table V-119. Ponderosa Pine, Supply Schedule Data, Cuba Timbershed.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	32,848	2,386,079			
10	(95,416)		9,853,209	125,136	78.74
10-20	157,984	12,239,287			
20	(284,684)		21,498,456	253,400	84.84
20-30	411,384	33,737,743			
30	(466,392)		10,004,855	110,016	90.94
30-40	521,400	43,742,598			

ponderosa pine within 40 miles (Tables V-118 through V-121). These haul distances are somewhat shorter than those of the other timbersheds in the two states.

Tables V-122 and V-123 show the aggregate supply figures for the timbershed. The road system for the typical haul (from which the haul costs were calculated) contain a fairly large percentage of poor quality roads (Table V-124). Therefore, although the distances are shorter, the proportion of the haul on the poorer quality roads is greater. This tends to offset the distance advantage in that poorer roads require more time and higher costs to travel on. It costs about two and one-half times more per mile to travel on a poor road than it does to travel on a road classed "excellent."

All the supply schedule graphs, ponderosa pine (Figures V-36 and V-37), mixed conifer (Figures V-38 and V-39), and aggregate (Figures V-40 and V-41), exhibit the fairly even distribution of timber. The graphs of the supply schedules for cost per mbf-to-volume are linear indicating the evenness of volume distribution.

The relative difference in costs is clear in the graphs. The entire volume of mixed conifer is available at less of a per mbf cost than the nearest ponderosa pine timber (Figures V-1 and V-3). Everything else being equal, the mixed conifers are a cheaper source of raw material.

(d) Problems and Opportunities

The mill believes stumpage, road costs, and increasing environmental costs are their largest single cost items. Stumpage cost is particularly important in the lower grade dimension material involving ponderosa pine. The stumpage price therefore is a key concern along with having timber available for sale when the mill requires it. The mill prefers the ponderosa pine because considerably more "uppers" can be recovered.

Table V-120. Delivered Costs: Mixed Conifer, Cuba Timbershed.

	Distance to the Mill (Miles)		
	0-10	10-20	20-30
Fixed Logging Cost ($/MBF)	55.42	55.42	55.42
Haul Cost ($/MBF)	8.27	14.37	20.47
Avg. Total Cost ($/MBF)	63.69	69.79	75.89
Total Acres (M)	19,135	10,406	13,459
Total Volume	74,627	40,583	52,490
Total Cum. Volume	74,627	115,210	167,700
Total Cost	4,752,994	2,832,288	3,983,466
Total Cum. Cost	4,752,994	7,585,282	11,568,748
Avg. Cost ($/MBF)	63.69	63.84	68.98

Table V-121. Mixed Conifer, Supply Schedule Data, Cuba Timbershed.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	74,627	4,752,994			
10	(94,918)		2,832,288	40,583	69.79
10-20	115,210	7,585,282			
20	(141,455)		3,983,466	52,490	75.89
20-30	167,700	11,568,748			

Table V-122. Delivered Costs: Aggregate, Cuba Timbershed.

	Distance to the Mill (Miles)			
	0-10	10-20	20-30	30-40
Total Acres	27,136	40,886	75,181	26,797
Total Volume	107,475	165,719	305,890	110,016
Total Cum. Volume	107,475	273,194	579,084	689,100
Total Cost	7,139,564	12,686,124	25,481,844	10,006,525
Total Cum. Cost	7,139,564	19,825,689	45,307,532	55,314,057
Avg. Cost ($/MBF)	66.43	72.57	78.24	80.27

Table V-123. Aggregate, Supply Schedule Data, Cuba Timbershed.

Distance	Cum. Vol.	Total Cum. Cost	MC	MP	$/MBF
0-10	107,475	7,139,564			
10	(190,335)		12,686,124	165,719	76.55
10-20	273,194	19,825,689			
20	(426,139)		25,481,844	305,890	83.30
20-30	579,084	45,307,532			
30	(634,092)		10,006,525	110,016	90.96
30-40	689,100	55,314,057			

Table V-124. Typical Haul to Cuba Mill.

	Distance (Miles)					
	0-10	10-20	20-30	30-40	40-50	50-60
Haul Dist. by road type						
Excellent (.39/mi)	2.25	6.75	11.25	15.75	20.25	24.75
Good (.51/mi)	.95	2.85	4.75	6.65	8.55	10.45
Fair (.55/mi)	.25	.75	1.25	1.75	2.25	2.75
Poor (1.0	1.55	4.65	7.75	10.85	13.95	17.05
Average haul dist.	5.00	15.00	25.00	35.00	45.00	55.00
Variable Round Trip Haul Cost ($/MBF)	3.05	9.15	15.25	21.35	27.45	33.54
Fixed Haul Cost ($/MBF)	5.22	5.22	5.22	5.22	5.22	5.22
Total Haul Cost ($/MBF)	8.27	14.37	20.47	26.57	32.67	38.76

Road type

Excellent	45%
Good	19%
Fair	5%
Poor	31%

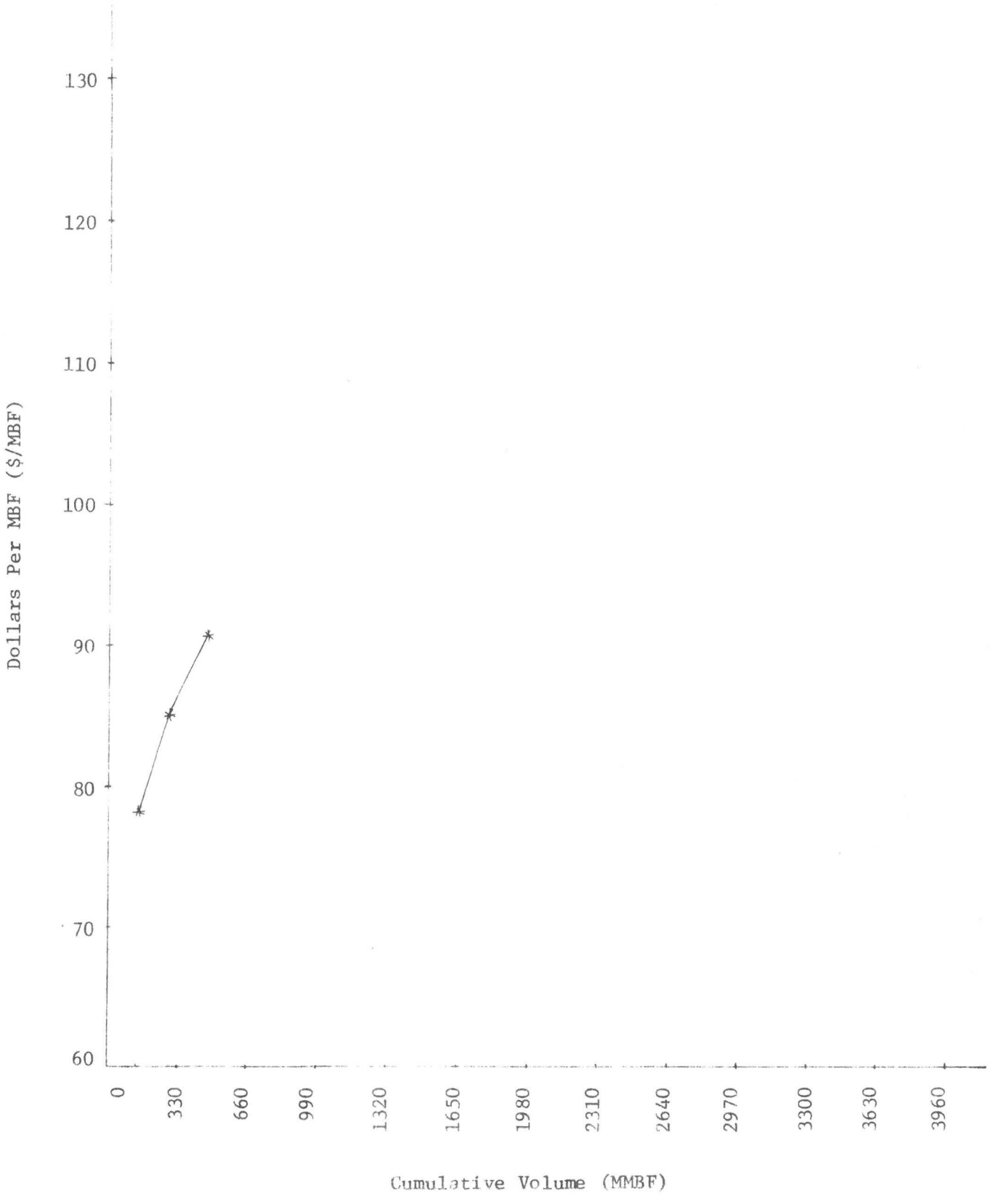


Figure V-36. Cuba Ponderosa Pine Supply Schedule by Volume.

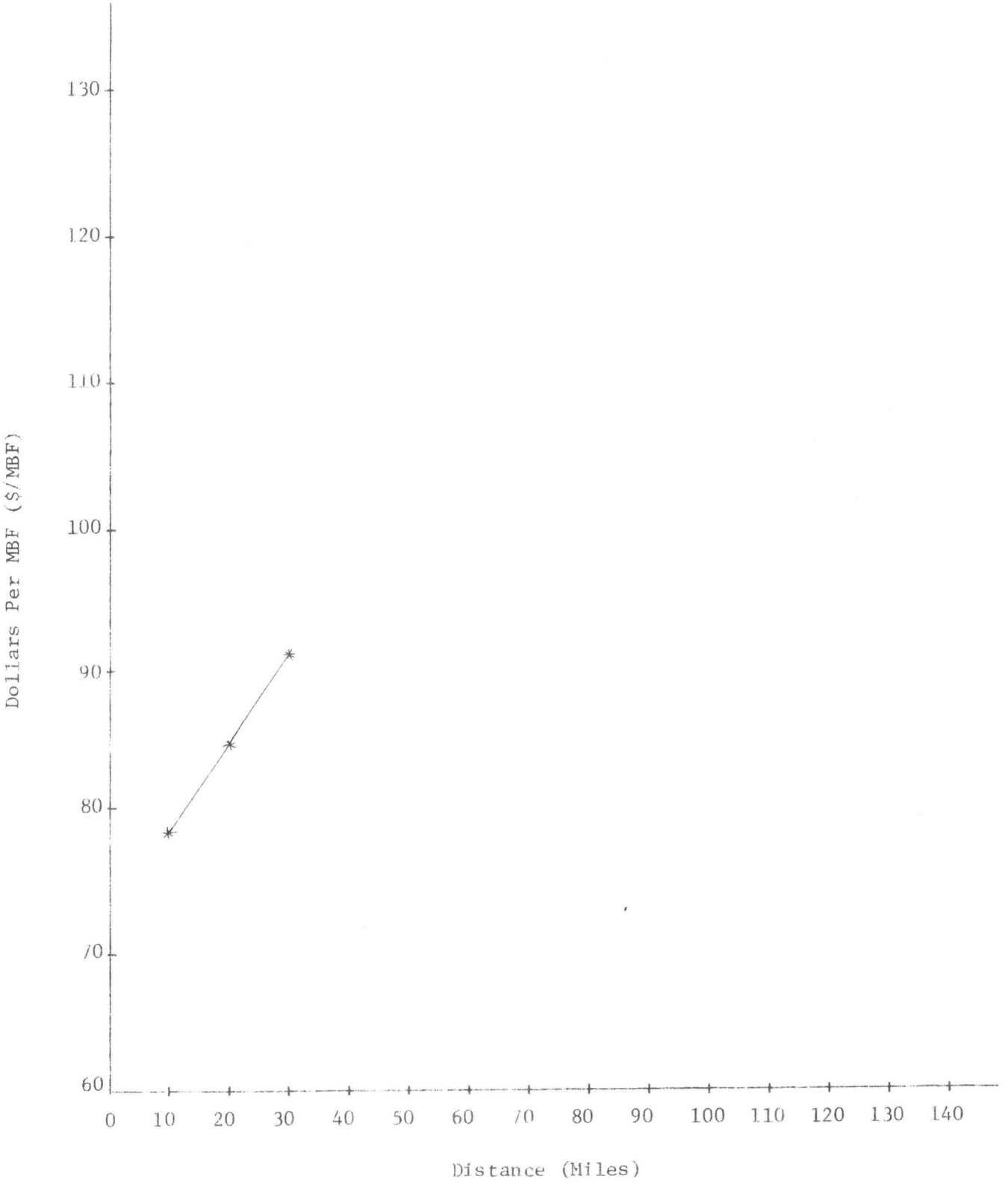


Figure V-37. Cuba Ponderosa Pine Supply Schedule by Distance.

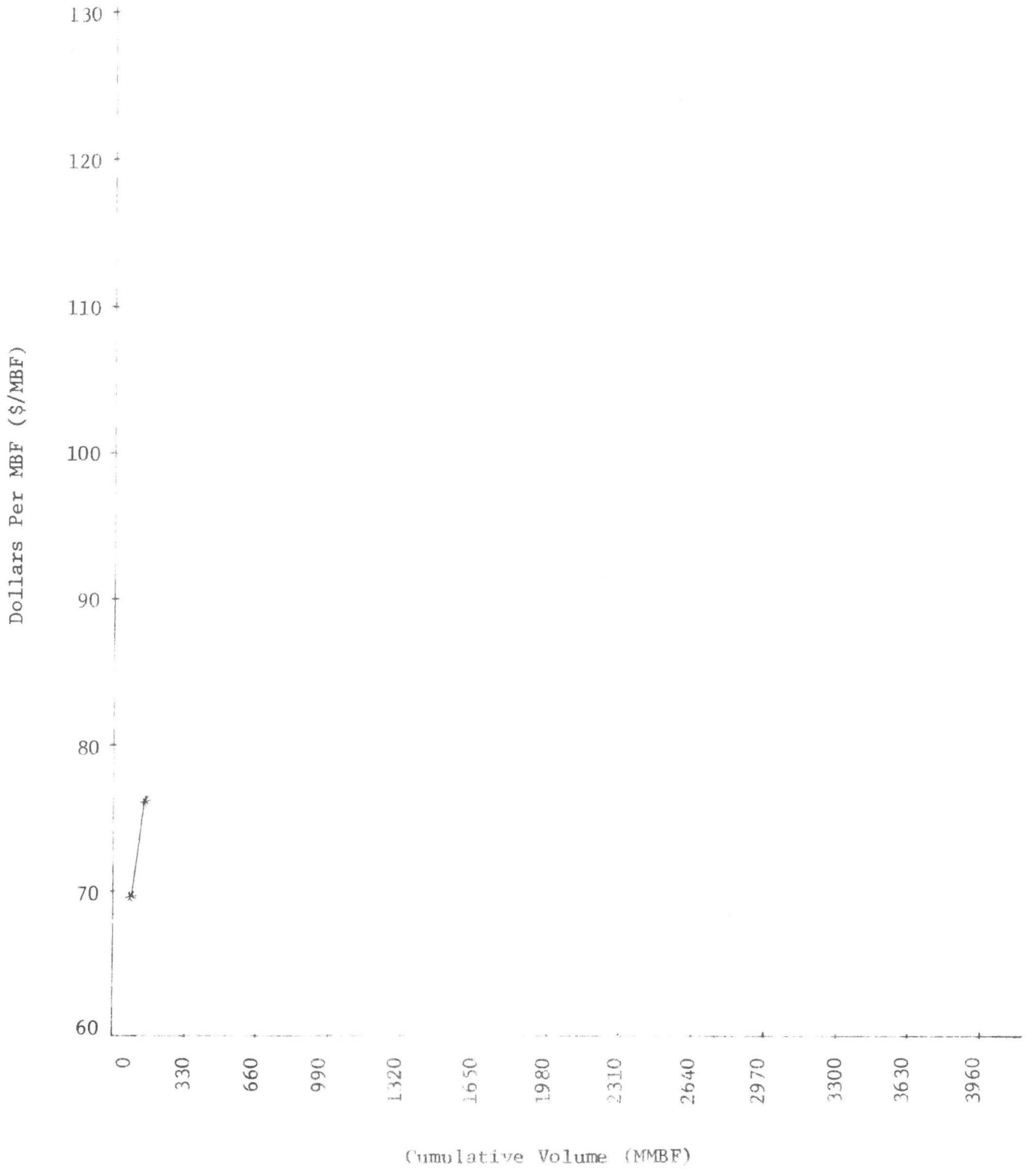


Figure V-38. Cuba Mixed Conifer Supply Schedule by Volume.

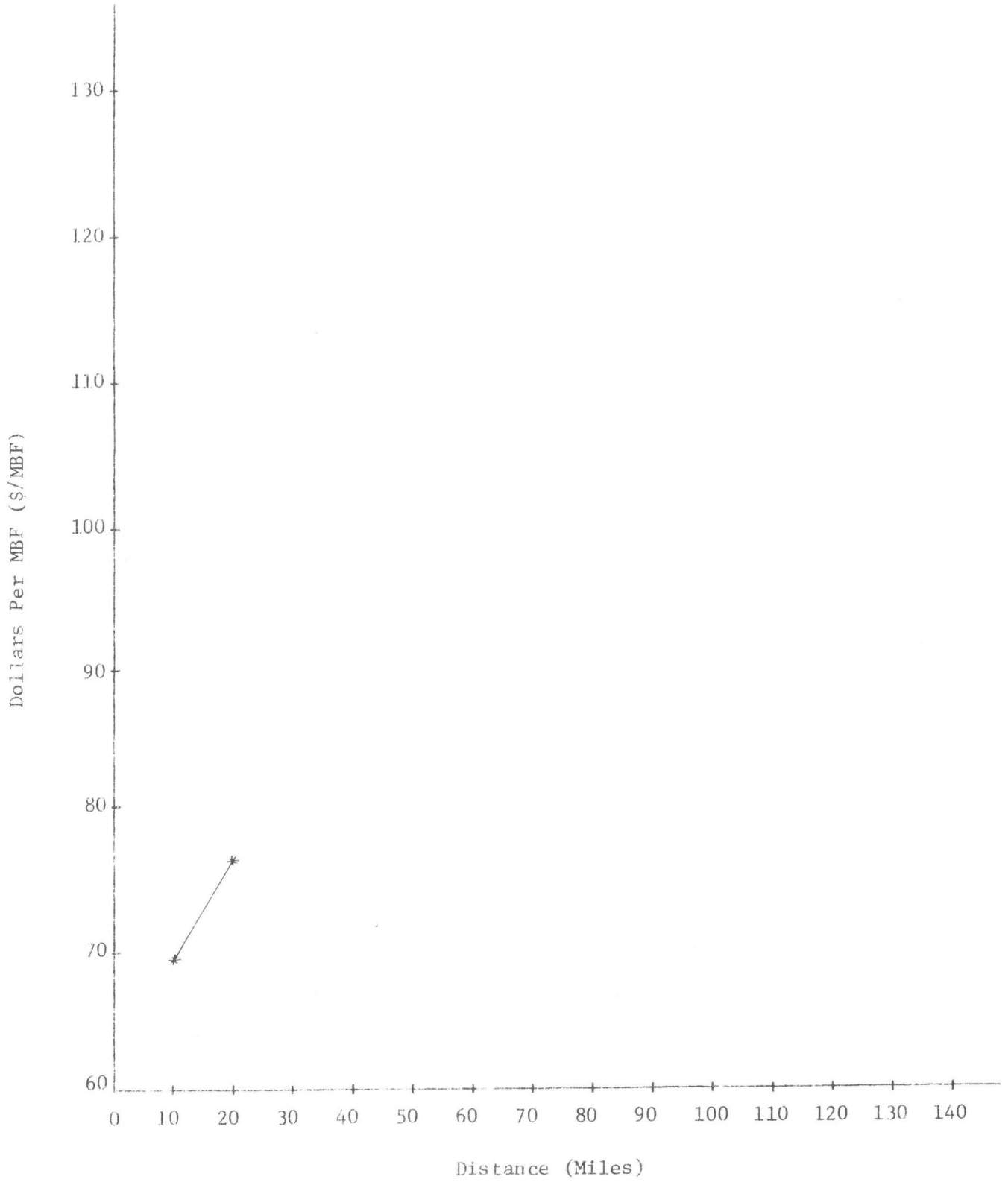


Figure V-39. Cuba Mixed Conifer Supply Schedule by Distance.

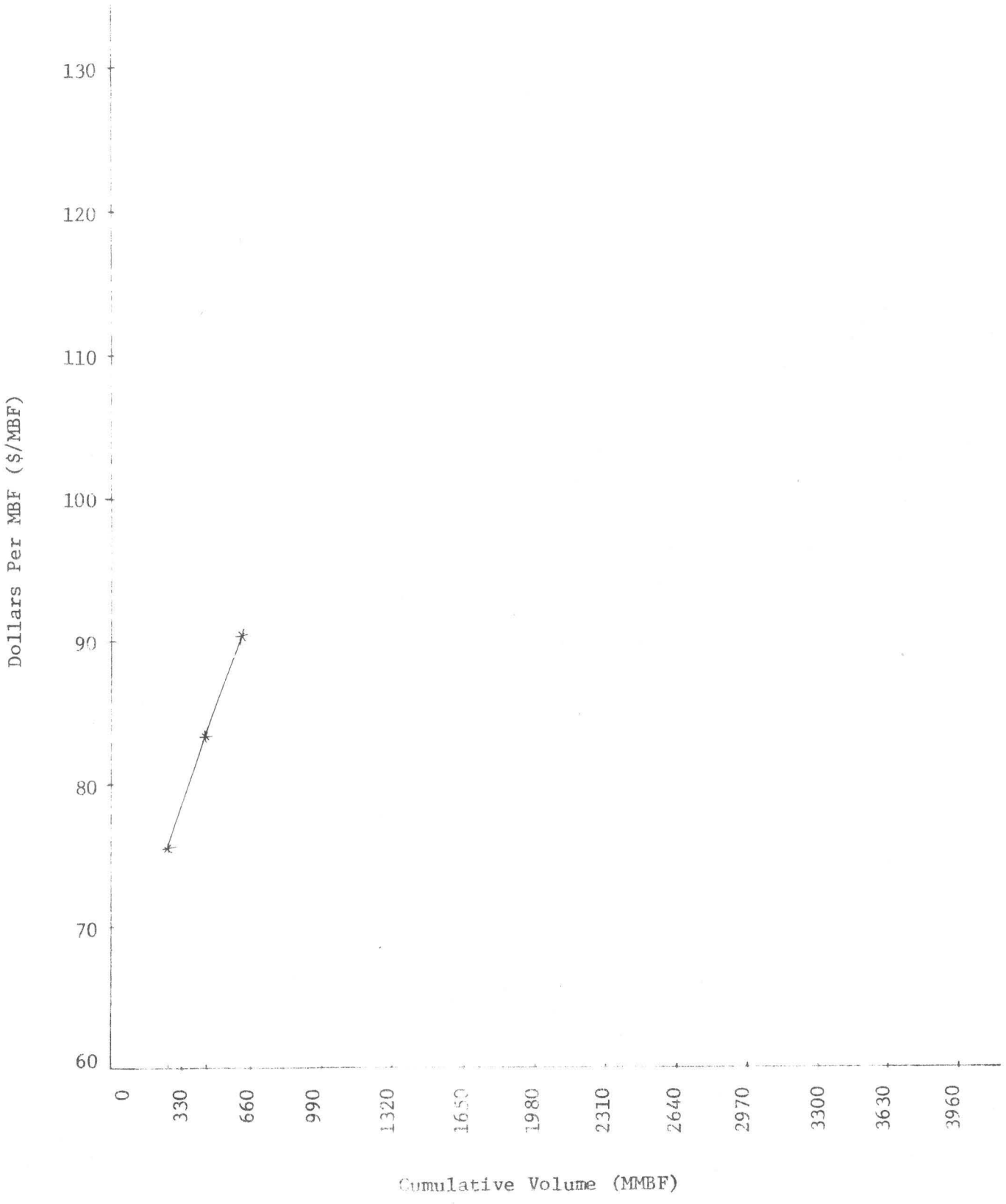


Figure V-40. Cuba Aggregate Supply Schedule by Volume.

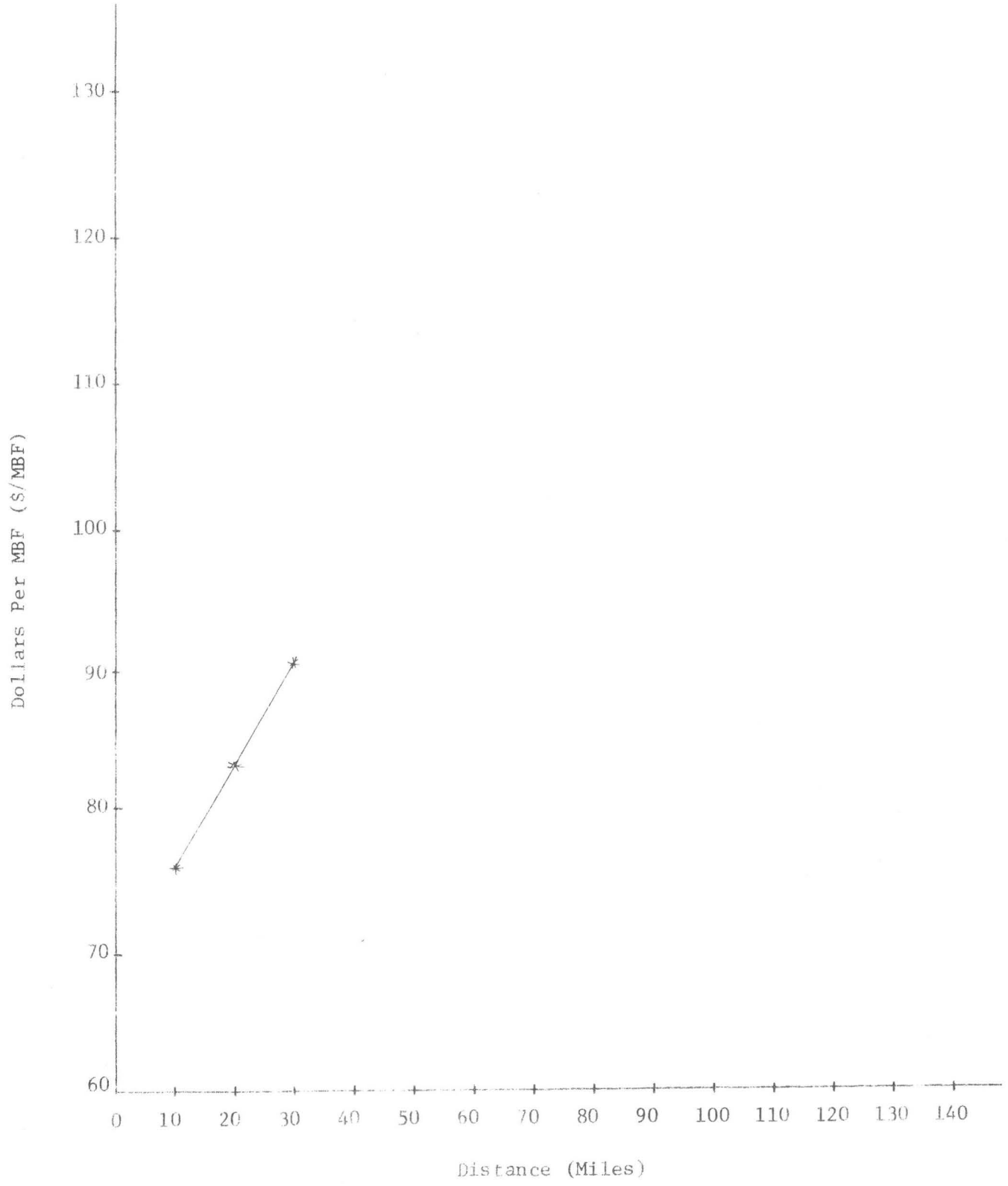


Figure V-41. Cuba Aggregate Supply Schedule by Distance.

Compared to the other two timbersheds in the area, the Cuba timbershed has a larger portion of ponderosa pine. In this way it is similar to the timbersheds located in Arizona.

VI. Markets for Arizona and New Mexico's Wood Products

This section discusses, in general terms, where the major market centers exist for wood products produced in the two states. This information was derived primarily from Western Wood Products Association publications.

Transportation rates for truck and rail hauling were identified for these major market centers. These rates were obtained through informal contacts with commerical carriers in the two states. Separate rates were calculated for each processing center.

Wholesale lumber prices were determined at each major market center. These were derived by contacting wholesalers at these areas by telephone and/or receiving price quotations from them via the mail.

A general assessment of the most profitable products and their market areas was made for the most common wood products manufactured in the two states. This assessment involved comparing wholesale lumber prices at the market area to freight costs from the processing centers. The larger the difference the better the opportunity for profit and the greater the comparative advantage in that market. Although a number of factors influence market potential, a comparison of these figures does give some indication of the best market/products.

a. Major Market Areas

Lumber and wood products manufactured in the Inland Region[9/] serve both domestic as well as export markets. Domestic markets exist

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9/ The Inland Region is defined as New Mexico, Arizona, Colorado, Utah, Wyoming, Montana, Idaho, Nevada, and the portions of Oregon, Washington, and California east of the Cascade and Sierra Nevada Mountains.

throughout the contenental United States while the export market includes Canada, Mexico, Hawaii, Alaska, and numerous overseas countries.

Statistics concerning exports compiled by the Western Wood Products Association (WWPA) for the first half of 1980 indicate shipments from the Inland Region to Canadian markets totalled 51,474 mbf. An additional 12,145 and 1,940 mbf were shipped as "other" export cargo and to Mexico respectively.

Within the continental United States, statistics indicate that the largest market for lumber and wood products produced in the Inland Region exists within the Region itself (Table VI-1). These figures are further substantiated by Table VI-2 which is specific to Arizona and New Mexico. In addition to the large internal market, Table VI-2 also indicates that large markets exist in the Midwest and South Central regions of the United States.

Of the shipments delivered from the Inland Region to the Midwest, Illinois, Michigan, Minnesota, and Wisconsin provide the largest markets respectively. Within the South Central area (Texas and Oklahoma), Texas is by far the largest consumer of lumber and wood products produced in the Inland Region. This is also evidenced by Table VI-2 which indicates that a total of 17.2% and 38.2% of Arizona and New Mexico's lumber and wood product output in 1978 was shipped to South Central states. California and Pennsylvania provide the largest markets within the Inland and Northeastern regions respectively.

Table VI-2 also indicates that the majority of shipments originating within Arizona and New Mexico are delivered by truck. This is due primarily to the large "local" demand. In general, as the distance from the origin to the market increases, transportation by rail becomes more

Table VI-1. Shipments to Identified Markets (in MMBF) From the Inland Region.

	1979	1980 (as of Oct. 1980)
Northeast	523	375
North Central	2,151	1,292
South	1,362	951
West	5,503	3,900
Total	9,539	6,518

Source: Western Lumber Facts, WWPA, Issued Dec. 17. 1980.

Table VI-2. 1978 Sawmill Statistics.

	Arizona	New Mexico
Mode of Transportation		
By rail	15.0%	4.0%
By truck	85.0%	96.0%
Principal Markets		
California	8.2%	1.7%
Other West	46.6%	42.8%
Midwest	22.2%	13.1%
Northeast	0.3%	0.2%
South Central	17.2%	38.2%
Southeast	5.1%	3.7%
Export	0.4%	0.3%

Source: 1979 Statistical Yearbook of the Western Lumber Industry. WWPA.

prevalent. This is evidenced by the fact that 96.7 percent of the shipments delivered to Pennsylvania during the first half of 1980 from the Inland Region were performed by rail. Most companies feel an 800-900 mile distance is the breakeven point between truck and rail.

b. Most Profitable Markets

Based on the informal survey of lumber wholesalers, the market lumber prices from highest to lowest are at: Chicago, IL; Denver, CO; Dallas, TX; El Paso, TX; Oklahoma City, OK; and Los Angeles, CA. Table VI-3 indicates the price differences for certain representative lumber types. Tables VI-4 to VI-9 give the average price quoted by wholesalers at each market center. In most cases, the difference between the highest value and lowest value (Chicago, IL vs. Los Angeles, CA) for a product range from about $50 to $250 per mbf; generally the better the product quality, the larger the difference in price.

Freight rates to markets vary by mode of transportation, rail or truck. Tables VI-10 and VI-11 give the truck freight rates to major market areas. Tables VI-12 and VI-13 give the rail freight rates. With a few exceptions truck rates are more favorable, even for hauls as far as Chicago, IL. This situation, coupled with the fact that using trucks normally involves less handling costs, make trucks the cheapest mode of lumber transportation.

The truck freight rates for each individual processing center ranges with distance. For any given market area the difference in processing center freight costs ranges from about $10 to $20 per mbf. For the bulk of the major market areas considered here, the Arizona mills typically have the highest freight costs. However, they do enjoy a freight advantage to the Los Angeles area. The Espanola and Albuquerque mills generally

Table VI-3. Comparison of Wholesale Prices for Selected Products at Major Market Areas.

Lumber type(mbf)	Chicago IL	Denver CO	Dallas TX	El Paso TX	Oklahoma City OK	Los Angeles CA
Dimension Douglas-fir 2x6 Std. or Btr.	$500.00	$315.00	$400.00	$290.00	$255.00	$250.66
Dimension Douglas-fir 2x8 Std. or Btr.	525.00	322.50	650.43	285.00	255.00	260.33
Boards Ponderosa pine #3 1"x12"	425.00	420.00	N/A	580.00	535.00	370.00
Dimension Spruce Std. & Btr.	350.00	N/A	257.57	N/A	N/A	220.00
Boards Spruce 1x12 #3	N/A	480.00	N/A	580.00	N/A	N/A

Table VI-4. Wholesaler Lumber Prices, Chicago, Illinois.[1/]

Species	Product	Dimensions	Grade	$/MBF
Douglas-fir	Dimension	2x4 R/L	Std. & Btr.	$480.00
		2x6		500.00
		2x8		525.00
Spruce	Dimension	2x4 R/L to 14'	Std. & Btr.	353.33
		2x6		350.00
		2x8		360.00
		2x10		430.00
Ponderosa Pine	KD Boards	1x4 through 1x10	#2	625.00
			#3 common	425.00
		1x10	#2 and Btr.	632.50
		1x12	#2 and Btr.	625.00
Southern Pines	Dimension	2x10 R/L	Std. & Btr.	495.00
Hem-fir	Dimension	2x10 R/L	Std. & Btr.	390.00

[1/] Abbreviations:

KD Boards = Kiln dried boards
R/L = Random lengths
S4S = Surfaced, four sides
S152E = Surfaced, one side, two edges
Std. & Btr. = Standard and better
Pet = Precut

Number of firms responding: 3; average contractor prices, 1981.

Table VI-5. Wholesale Lumber Prices, Denver, Colorado.[1/]

Species	Product	Dimensions	Grade	$/MBF
Douglas-fir	Dimension	2x4 to 14'	Std. & Btr.	305.00
		2x6		315.00
		2x8		322.50
		2x10		382.50
		2x12		385.00
		4x4		510.00
		4x6		525.00
Hem-fir	Dimension	2x4 to 14'	Std. & Btr.	277.50
		2x6		285.00
		2x8		286.00
		2x10		333.75
		2x12		335.00
Spruce	Sheathing Boards	1x4 8' to 14'	#3 S4S	272.00
		1x6		350.00
		1x8		350.00
		1x10		360.00
		1x12		480.00
		7/8x4 R/L	#3 0104 S1S2E	280.00
		7/8x6		330.00
		7/8x8		330.00
		7/8x10		330.00
Ponderosa Pine	KD Boards	1x4 6' to 16'	C & Btr.	1,060.00
			D	540.00
			#2	410.00
			#3 Common	280.00
		1x6 6' to 16'	C & Btr.	1,355.00
			D	640.00
			#2	425.00
			#3 Common	305.00
		1x8 R/L (6'-16')	C & Btr.	1,135.00
			D	615.00

Table VI-5. (Continued).

Species	Product	Dimensions	Grade	$/MBF
Ponderosa Pine	KD Boards		#2	370.00
			#3 Common	300.00
		1x10 R/L (6'-16')	C & Btr.	1,180.00
			D	695.00
			#2	375.00
			#3 Common	285.00
		1x12 R/L (6'-15')	C & Btr.	1,615.00
			D	1,075.00
			#2	550.00
			#3 Common	420.00
Pine (White Woods)	KD Studs	2x4 Pet 92 5/8"	Stud Grade	272.00
		2x6 Pet 92 5/8"	Stud Grade	285.00
	Dimension	2x4 8' to 14'		265.00
		2x6 8' to 14'		265.00

1/ Number of firms responding: 2; average contractor prices, 1981.

Table VI-6. Wholesale Lumber Prices, Dallas, Texas.[1/]

Species	Product	Dimensions	Grade	$/MBF
Douglas-fir	Dimension	2x4 R/L 8 to 20 ft.	Utility grade	343.28
		2x6 R/L 8 to 20 ft.	#3	303.71
		2x8 22 to 28 ft.	#3	434.00
		2x12 22 to 28 ft.	#3	329.00
		2x4 8 to 20 ft.	Select	450.00
		2x6 8 to 20 ft.		400.00
		2x8 8 to 20 ft.	Std. & Btr.	650.43
		2x10 22 to 28 ft.	Std. & Btr.	751.50
White pine	Boards	1x4 R/L	C & Btr., Clear	2,235.00
		1x6		2,565.00
		1x8		2,595.00
		1x12		2,965.00
Ponderosa Pine	KD Boards	1x4 R/L	D Grade	732.50
		1x6		880.00
		1x8		842.00
		1x12		1,450.00
		1x4	Common	420.00
Spruce	Dimension	2x4 8 to 20 ft.	Utility	267.57
		2x6 8 to 20 ft.	#3	257.57

[1/] Number of firms responding: 4; average contractor prices, 1981.

Table VI-7. Wholesale Lumber Prices, El Paso, Texas.[1/]

Species	Product	Dimensions	Grade	$/MBF
Douglas-fir	Dimension	2x4 R/L	Std. & Btr.	315.00
		2x6		290.00
		2x8		285.00
		2x10		330.00
		2x12		335.00
		2x4 R/L	Select Structural	750.00
		2x6		750.00
		2x8		750.00
		2x10		750.00
		2x12		700.00
Ponderosa Pine	Dimension	2x4 R/L	Std. & Btr.	327.50
		2x6		332.50
		2x8		323.50
	KD Boards	1x12	#2 & Btr.	878.00
			#3	580.00
White fir	Dimension	2x4 R/L	Utility Grade	230.00
Spruce	Boards	1x6 R/L	#2	585.00
		1x8		
		1x10		

[1/] Number of firms responding: 3; average contractor prices, 1981.

Table VI-8. Wholesale Lumber Prices, Oklahoma City.[1/]

Species	Product	Dimensions	Grade	$/MBF
Douglas-fir (West Coast)	Dimension	2x4 R/L to 16'	Std. & Btr.	255.00
		2x6		255.00
		2x8		255.00
		2x10		255.00
		2x12		255.00
Ponderosa Pine	Boards	1x12	#3	535.00
			#2	730.00
			D Grade	1,610.00
			Moulding grade	880.00
			C & Btr.	2,195.00
Spruce	Sheathing Board	1x6 up to 16'	#2	395.00

[1/] Number of firms responding: 2; average contractor prices, 1981.

Table VI-9. Wholesale Lumber Prices, Los Angeles, California.[1/]

Species	Product	Dimensions	Grade	$/MBF
Douglas-fir	Dimension	2x4 R/L	Std. & Btr.	250.66
		2x6		250.66
		2x8		260.33
		2x10		310.66
		2x12		316.66
		4x4		331.50
		4x6		335.50
		2x4 92 1/4"	Select Structural	270.00
		2x4 10'	Stud Grade	250.00
Ponderosa Pine	KD Boards	1x12 6' and 8'	#3 Common	370.00
			#2	450.00
			D Grade	580.00
			Moulding Grade	640.00
			C and Better	1,000.00
Spruce	Dimension	2x4 R/L	Std. & Btr.	226.00
		2x6		220.00
		2x8		230.00
		2x10		290.00
		2x12		305.00
	Decking	2x6 R/L	S2S	313.00
Hem-fir	Dimension	2x4 R/L	Std. & Btr.	240.00
		2x10		296.00

[1/] Number of firms responding: 4; average contractor prices, 1981.

Table VI-10. Average Truck Freight Rates per MBF to Selected Locations

To	From					
	Fredonia	Eagar	Albuquerque	Espanola	Cuba	Alamogordo
Dallas, TX	$43.30	$32.95	$25.92	$26.77	$29.12	$24.21
El Paso, TX	28.48	15.89	20.05	16.53	16.74	10.35
Okla. City, OK	40.95	30.61	23.78	23.78	26.34	24.85
Denver, CO	37.57	39.57	32.95	31.57	32.95	35.19
Los Angeles, CA	30.72	38.61	46.29	51.51	50.77	47.99
Kansas City, KS	50.77	42.34	31.57	30.61	33.59	33.59
Phoenix, AZ			26.45	31.03	31.03	37.75
Chicago, IL	64.63	59.51	45.65	45.65	53.33	

1/ Cost per MBF includes 18.5 percent fuel surcharge and are based on 1,800 pounds per MBF.

Table VI-11. Average Lumber Freight Costs by Truck to Selected Locations[1/]

To	From					
	Fredonia	Eagar	Albuquerque	Espanola	Cuba	Alamogordo
Dallas, TX	$ 962.22	$ 732.33	$ 575.91	$ 594.87	$ 647.01	$ 537.99
El Paso, Tx	632.79	353.13	445.56	367.35	372.09	229.89
Okla. City, OD	910.08	680.19	528.51	585.39	585.39	552.21
Denver, Co	879.27	879.27	732.33	701.52	732.33	782.10
Los Angeles, CA	682.56	857.94	1,028.58	1,144.71	1,128.12	1,066.50
Kansas City, KS	1,128.12	940.89	701.52	680.19	746.55	746.55
Phoenix, AZ			587.76	689.67	689.67	838.98
Chicago, IL	1,436.22	1,322.46	1,014.36	1,014.36	1,185.00	1,123.38

[1/] All cost figures are based on a 40,000 pound minimum weight and include an 18.5 percent fuel surcharge.

Table VI-12. Average Rail Lumber Freight Rates per MBF to Selected Locations.[1/]

To	From		
	Albuquerque	Eagar	Alamogordo
Dallas, TX	$41.30	$49.82	$27.23
El Paso, TX	18.52	27.04	24.82
Okla. City, OK	38.34	46.86	
Denver, CO	31.86	40.38	62.05
Kansas City, KS	49.08	57.60	35.01
Chicago, IL	57.79	64.27	39.08
Los Angeles, CA	52.79		52.79
Phoenix, AZ	52.79		

[1/] Cost per MBF includes 2.9 percent fuel surcharge and are based on 1,800 pounds per MBF.

Table VI-13. Average Lumber Freight Costs by Rail to Selected Locations.[1/]

	From					
	Albuquerque		Eagar[2/]		Alamogordo	
	Min. Wgt.	Cost	Min. Wgt.	Cost	Min. Wgt.	Cost
Dallas, TX	50 M	$1,147.34	50 M	$1,384.01	100 M	$1,512.63
El Paso, TX	50 M	514.50	50 M	751.17	100 M	1,378.86
Okla. City, OK	50 M	1,065.02	50 M	1,301.69		
Denver, CO	50 M	884.94	50 M	1,121.61	60 M	2,068.29
Kansas City, KS	50 M	1,363.43	50 M	1,600.10	100 M	1,944.81
Chicago, IL	50 M	1,605.24	50 M	1,785.32	100 M	2,171.19
Los Angeles, CA	40 M	1.173.06			75 M	2,199.49
Phoenix, AZ	40 M	1,173.06				

[1/] All costs include 2.9 percent fuel surcharge.

[2/] Actual location is McNary, AZ which is 17 miles from Eagar.

have the best overall freight advantage. Alamogordo has the best rates for the Texas markets. All processing centers have reasonably the same freight rates for the Denver and Phoenix markets. These are the most centrally located market areas for the two states.

For most of the New Mexico mills the freight costs for Los Angeles and Chicago are reasonably the same. Yet in the case of wholesale prices Chicago offers considerably higher prices. Chicago is therefore a much more profitable market area. For the most part, the differences in freight rates are not nearly as large as the differences in wholesale prices. Other things being equal, most mills should try to market in Chicago, Denver, Dallas, and El Paso (in that order) as well as local markets in Phoenix and Albuquerque. These seem to be the most profitable market areas. As one might expect, the higher quality the product, the larger the profit.

VII. Comparison of Timbershed Sale Characteristics

a. Statistical Procedures

Once all timbersheds had been individually analyzed, a comparison of sale parameters between timbersheds was made using one-way analysis of variance (AOV). Within the AOV, each timbershed becomes a sample concerning a particular parameter. Within each sample, each sale, for which a measurement on the parameter was available, serves as an observation. For most analyses, there are four timbersheds and 25 parameters. In the Fredonia timbershed there were 10 sales/observations; Eagar timbershed, 11 sales/observations; Alamogordo timbershed, 9 sales/observations; and Cuba, Albuquerque, and Espanola timbershed, 23 sales/observations. The Cuba, Albuquerque, and Espanola sales were combined for the analysis except in the case of hauling distance and hauling costs.

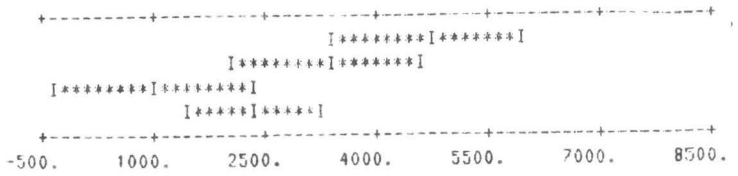
From each of the samples (timbersheds), estimates of the true population means were calculated for comparison. If the population means (for a given parameter) between timbersheds can be shown to be statistically equal then one can assume each sample was drawn from a single population (i.e. the mean value of the parameter is constant for all timbersheds).

A standard F-test was used to test for equality. A 95 percent confidence interval based on pooled standard deviations was also calculated. These confidence intervals give a visual check to determine which timbershed means differ significantly when an F-test implies inequality of means. The confidence intervals and F-test results are summarized in Figure VII-1.

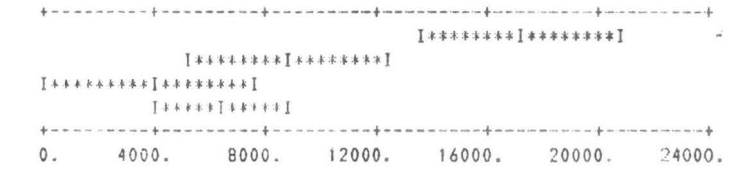
For example, in Figure VII-1, note the results shown for sale acres. An F-test showed the sample means (timbersheds) to be highly unequal (.01 level). This can be easily confirmed by looking at the confidence intervals. Timbershed 1, Fredonia, is much larger than both samples in timbershed 3, Alamogordo, and timbershed 4, Cuba, Albuquerque and Espanola. Similar interpretations could be made for other parameters.

b. Comparison

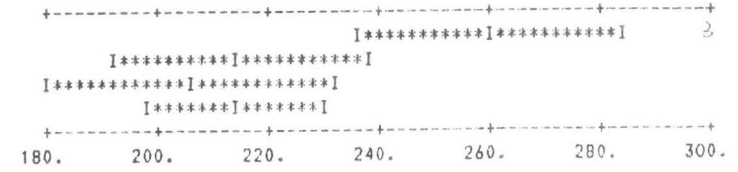
The size of the mixed conifer and ponderosa pine timber is larger in the Arizona timbersheds. The sales generally involve larger acreage and volumes, and have less defect. These advantages are indicated in the logging costs which are somewhat less. Road mileage is generally higher in Fredonia's case but the volumes available make specified road costs per mbf less. Since timber sale characteristics are more favorable in Arizona and costs generally the same or less than other timbersheds, advertised rates, the residual, are



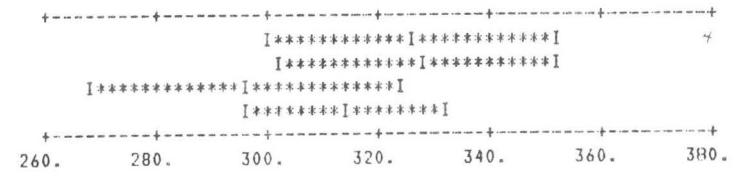
Acres**



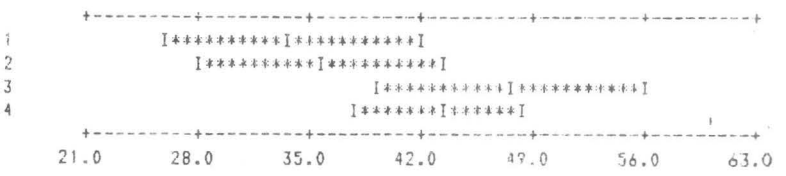
Scribner Volume** (mbf)



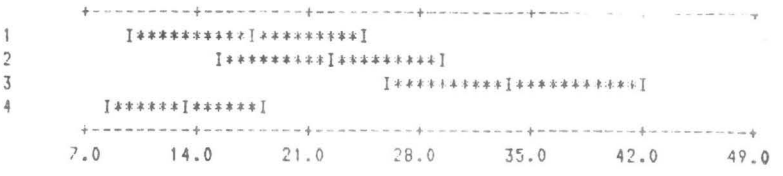
Selling Value Log Tally*



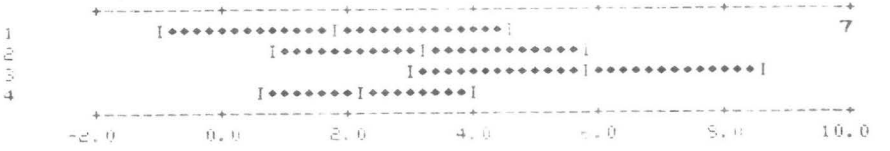
Selling Value Log Scale



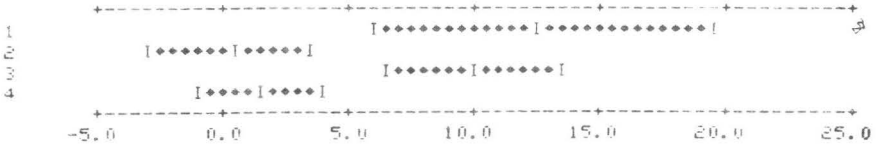
Logging Costs*



Environmental Protection Costs**

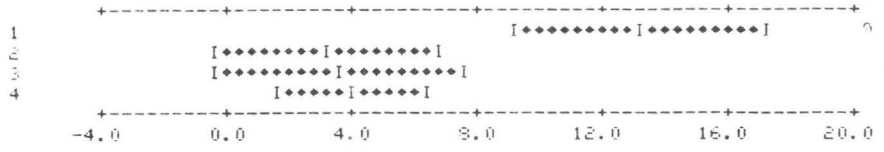


Temporary Road Miles (n=52)

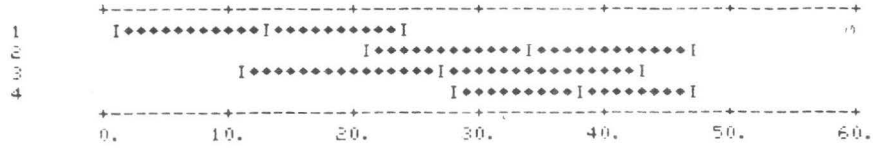


Temporary Road Costs** (n=32)

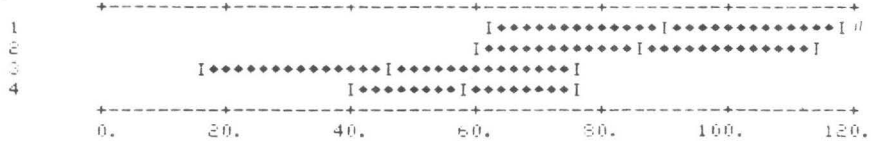
Figure VII-1. Parameter confidence intervals (95%) and AOV results.[1]



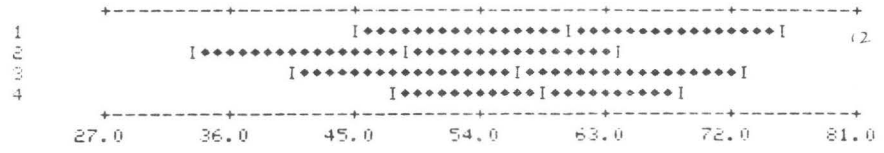
Specified Road Miles* (n=52)



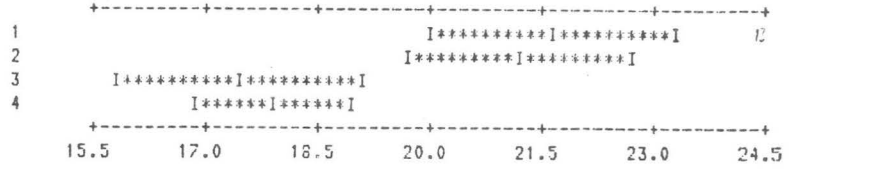
Specified Road Costs* (n=37)



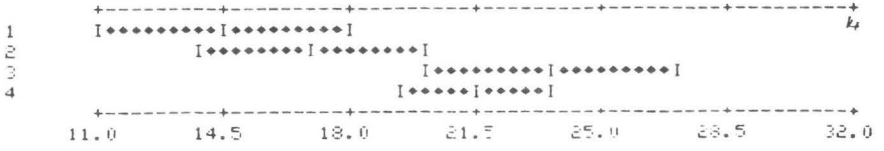
Average Advertised Rate*



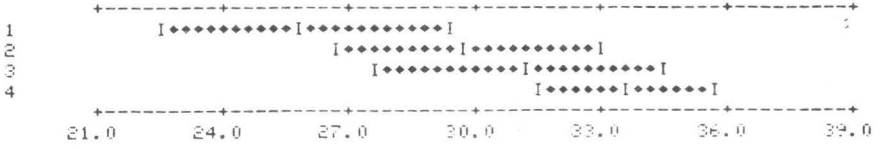
Piling Costs (n=51)



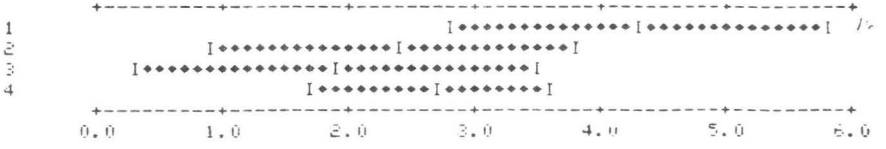
Average DBH**



Average Defect** (2%; n=52)

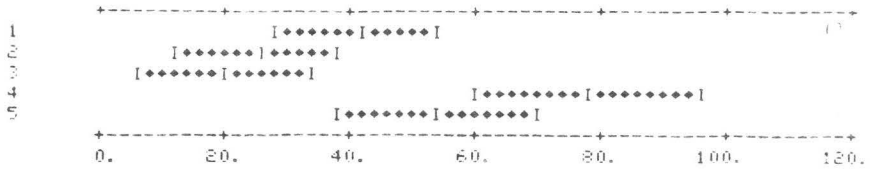


Overrun** (%; n=52)

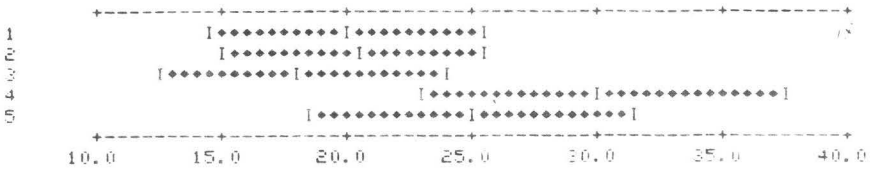


Road Maintenance Cost

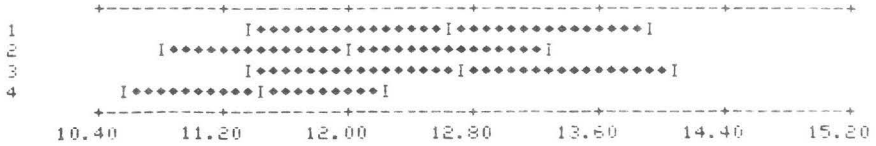
Figure VII-1--Continued.



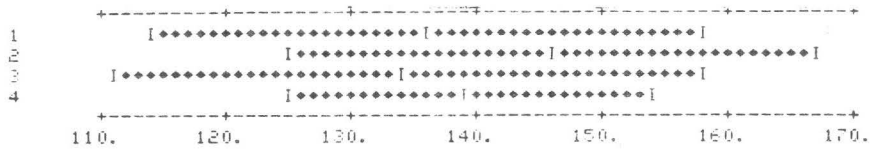
Haul Distance** (n=43)



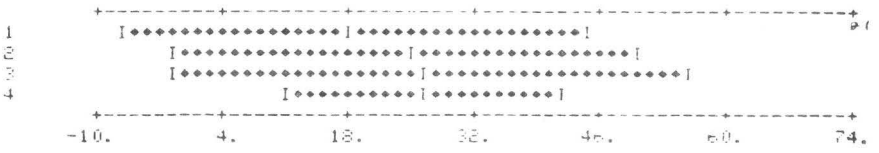
Haul Cost (n=43)



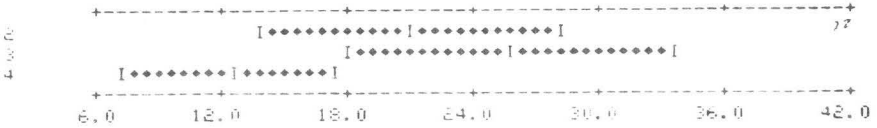
General Logging Overhead



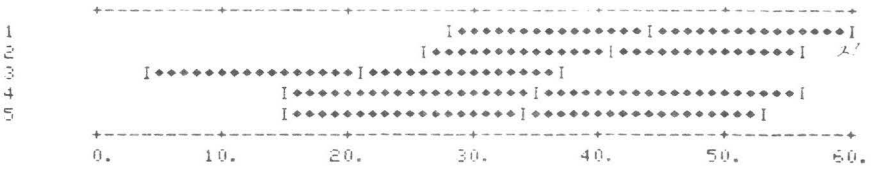
Manufacturing Costs



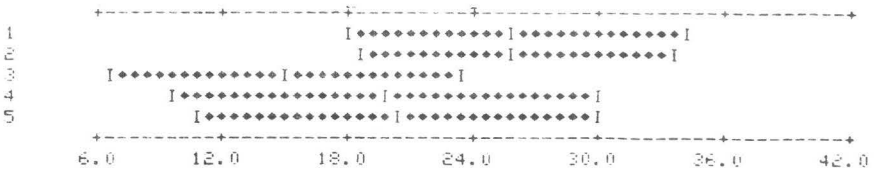
Logging Costs (n=48)



Total Slash Costs* (n=43)

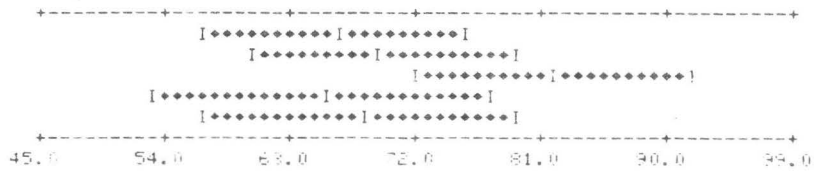


Average Advertised Rate/Total Cost (%) (n=43)



Average Advertised Rate/Selling Value Log Scale (%) (n=43)

Figure VII-1--Continued.



Total Cost/Selling Value Log Scale (%) (n=43)

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[1]Timbersheds are represented as follows: 1 = Fredonia, 2 = Eagar, 3 = Alamogordo, 4 = Cuba, Albuquerque, and Espanola combined except when a fifth sample is specified. When a fifth sample is listed, 4 = Albuquerque and 5 = Espanola. The total number of observations on each paramter was 53 except where otherwise noted.

*Reject the null hypothesis (H_0: all sample means equal) with $\alpha = 0.05$.

**Reject the null hypothesis with $\alpha = 0.01$.

Figure VII-1--Continued.

significantly higher. Stumpage price for mixed conifer/ponderosa pine can therefore be expected to be a larger proportion of their total costs of operation. The comparison here points out the importance of reviewing the economics of the entire timbershed operation. Just because a firm's stumpage costs are a larger portion of their total costs does not necessarily mean they are being treated unfairly concerning appraised stumpage rates.

In general, the Arizona timbersheds, in particular Fredonia, seem to offer the best opportunity, from a timber supply standpoint, to develop an economic mixed conifer/ponderosa pine management program. The favorable timber characteristics and costs provide an economic opportunity to develop more intensive utilization programs.

The Alamogordo timbershed exhibits the opposite situation. Sale acreage, volumes and timber dbh are the smallest of the timbersheds in the two states. Defect is the highest. At the same time, selling values of lumber are the lowest. Costs generally are the same or higher for all aspects of timber procurement. It is no wonder that total cost as a percentage of selling value averages 12 percent more for Alamogordo when compared to the other timbersheds. This occurs even though advertised stumpage rates are generally less for Alamogordo.

From an economic point of view the Alamogordo timbershed provides a difficult situation for constructing intensive timber management/wood utilization programs. The only aspect where the timbershed does enjoy an advantage is in hauling distance. Perhaps from a supply standpoint this advantage could be emphasized in sale programs. Further it would seem appropriate to allow more of a profit and risk given the poor total cost/selling value ratio. In any case, developing economically

viable intensive management programs here will be difficult without some innovations or incentives.

The timbersheds in the northern part of New Mexico exhibit more favorable economic conditions than Alamogordo but less so than the Arizona timbersheds. The most outstanding differences involve low environmental costs for northern New Mexico and high specified road costs. The individual processing centers, Espanola and Albuquerque, have fairly large haul distances and costs. Advertised rates for stumpage are less than in the case of Arizona timbersheds which, in total, results in the total cost/selling value ratio being close to that of the Arizona timbersheds.

In summary, based on this comparison, it could be said that from an economic perspective, investment in intensive management in order of Fredonia, Eagar, northern New Mexico, and Alamogordo timbersheds would probably be the most likely to succeed and yield the highest wood product and stumpage returns. This statement, of course, is based on timber characteristics and the procurement situation within the timbersheds. Additional criteria, besides these, would have to be considered in administering multiple use programs. However, the driving force behind application of silvicultural prescriptions is economically viable harvesting and wood utilization. This has to be a key concern in developing intensive timber management programs and wood utilization capacities.

c. Cable Logging

Since the sales that involve cable logging had both conventional and cable logging systems it was impossible to separate cable logging costs out in the appraisal. Instead some regional averages were collected in order to provide some basis for comparison. These costs

Table VII-1. Cable Logging Costs, Regional Averages, Stump-to-truck.

Felling and bucking	$ 20 - 29/mbf, net log scale
Yarding	90 - 110/mbf, net log scale
Loading	12 - 16/mbf, net log scale
Stump-to-truck	122 - 155/mbf, net log scale

Source: Dennis Caird, Logging Specialist, USFS, R-3.

are considerably higher than the average stump-to-truck costs region-wide of $37.00/mbf log scale (Figure VII-1).

Obviously some incentive must be available to develop a cable logging program. Several items are being implemented to enhance the desirability of cable logging. First, the two states have been divided into subregions on the basis of terrain, timber type and/or purchasing history (these correspond closely to the processing centers described in this report). As a unit, Forests in these subregions would provide a significant amount of cable sales totalling at least 25 mmbf over a 5-year period. Second, these sales would initially involve stands averaging 5 mbf/acre. Later this may be reduced but not to less than 3 mbf/acre. The yarding distance would not exceed 1300 feet. Finally, costs of yarding equipment would be depreciated over five years and an additional 2 percent be allowed for profit and risk. The purchaser would be allowed one year to obtain the capability for cable logging and this time would not be used in rate redeterminations.

If these incentives are made available and there is a reasonably strong market for wood products it is likely that a cable program could be developed in R-3. The results of this analysis (Figure VII-1)

show that Arizona timbersheds should be the most likely to provide economically viable possibilities along these lines.

VIII. Summary

a. Raw Material

The mixed conifer type is found primarily in the North Kaibab and Apache National Forests in Arizona; the Lincoln National Forest and Mescalero Indian Reservation in southeastern New Mexico; Zuni and Jemez mountains in northern New Mexico, which include the Santa Fe and Carson National Forests as well as large acreages of state, private and Indian lands. The major processing centers which have access to this timber are located in Fredonia, and Eagar, Arizona and Alamogordo, Cuba, and Espanola, New Mexico. The timbersheds adjacent to these areas have varying amounts of mixed conifers. Within the standard component Eagar, Fredonia and Alamogordo have the largest volumes. Albuquerque, Espanola, and Cuba have smaller volumes, in that order. The acreage of mixed conifer is located in fairly homogenous large blocks in Fredonia, Cuba and Alamogordo timbersheds, whereas in Eagar, Albuquerque and Espanola timbersheds this acreage is scattered in blocks throughout the timbershed. In all timbersheds the mixed conifer type occupies the bulk of the most productive timber sites.

The dbh size is largest in Arizona timbersheds, about 21" for both ponderosa pine and mixed conifer. In New Mexico's timbersheds mixed conifer is generally larger than ponderosa pine. In both cases, mixed conifer and ponderosa pine, it is smaller compared with Arizona timber (21" vs. 17" for ponderosa pine and 21" vs. 18" for mixed conifer). In general, defect levels are higher for both types in New Mexico. In summary, timber quality for producing sawtimber is more favorable in Arizona, and within Arizona it is best in Fredonia's case.

The amount of marginal land varies by timbershed. The largest amount is in the Eagar timbershed, the least in the Fredonia timbershed. For the most part, the marginal lands exist as small, scattered blocks. Mixed conifers are not the major timber type in the marginal land category. For all timbersheds, except Alamogordo, mixed conifers make up only 10-35 percent of those lands classed marginal. The timber on marginal land is generally of much larger size than timber on standard component lands.

All processing centers are heavily dependent on the U.S. Forest Service for timber supplies. The only processing center not 90 to 100 percent dependent on U.S. Forest Service timber is Alamogordo. In this case about 50 percent of the timber comes from Forest Service lands, the other 50 percent from Indian lands. Generally, the species mix used includes 70 to 80 percent ponderosa pine and 20 to 30 percent mixed conifer. The trend has been to include more mixed conifer volumes in timber sales. For most timbersheds the cut should be about 60 percent in the pine type and 40 percent in the mixed conifer type, if cut was to correspond with available volumes. In Arizona, it should be approximately 65 percent pine and 35 percent mixed conifer.[10/]

In most cases the actual cut is very close to the programmed allowable cut in all timbersheds. The only timbersheds having somewhat less harvest than the programmed cut are Fredonia and the Santa Fe National Forest. Trends vary by timbershed but generally there has been a decline in harvests over the last ten years.

10/ This statement is based on volumes typed as pine or mixed conifer. Obviously there is some ponderosa pine volume in the mixed conifer type.

There can be major increases in timber supply if potential yield programs were implemented. The greatest proportional increases in volumes could occur in northern New Mexico timbersheds and the Alamogordo timbershed where timber harvest could increase 3 and 5 times, respectively, over present levels of programmed cut. Arizona timbersheds could also be increased but much less so.

Mill capacities are presently very close to programmed cut levels. The only timbershed that seems to have more programmed cut than mill capacity is Alamogordo. However, indications are that this level of programmed cut will be reduced significantly in the future. Under potential yield programs, New Mexico's processing centers would have the greatest opportunities for expanding capacity based on raw material supplies.

Developing a potential yield program would involve intensive application of the region's silvicultural prescriptions. These prescriptions primarily involve using variations of the shelterwood method and group selection prescriptions. These general prescriptions are modified somewhat when considering special component lands or areas infested by dwarf mistletoe. For the most part these prescriptions, in mixed conifer stands, result in some timber of small size and poor quality being removed as part of the sale. The possibility of a successful potential yield program relies heavily on the ability to utilize smaller-sized material. At present, the Eagar timbershed has the most capability along these lines since there is a nearby pulp and paper mill. Other processing centers do not produce product lines which utilize such materials.

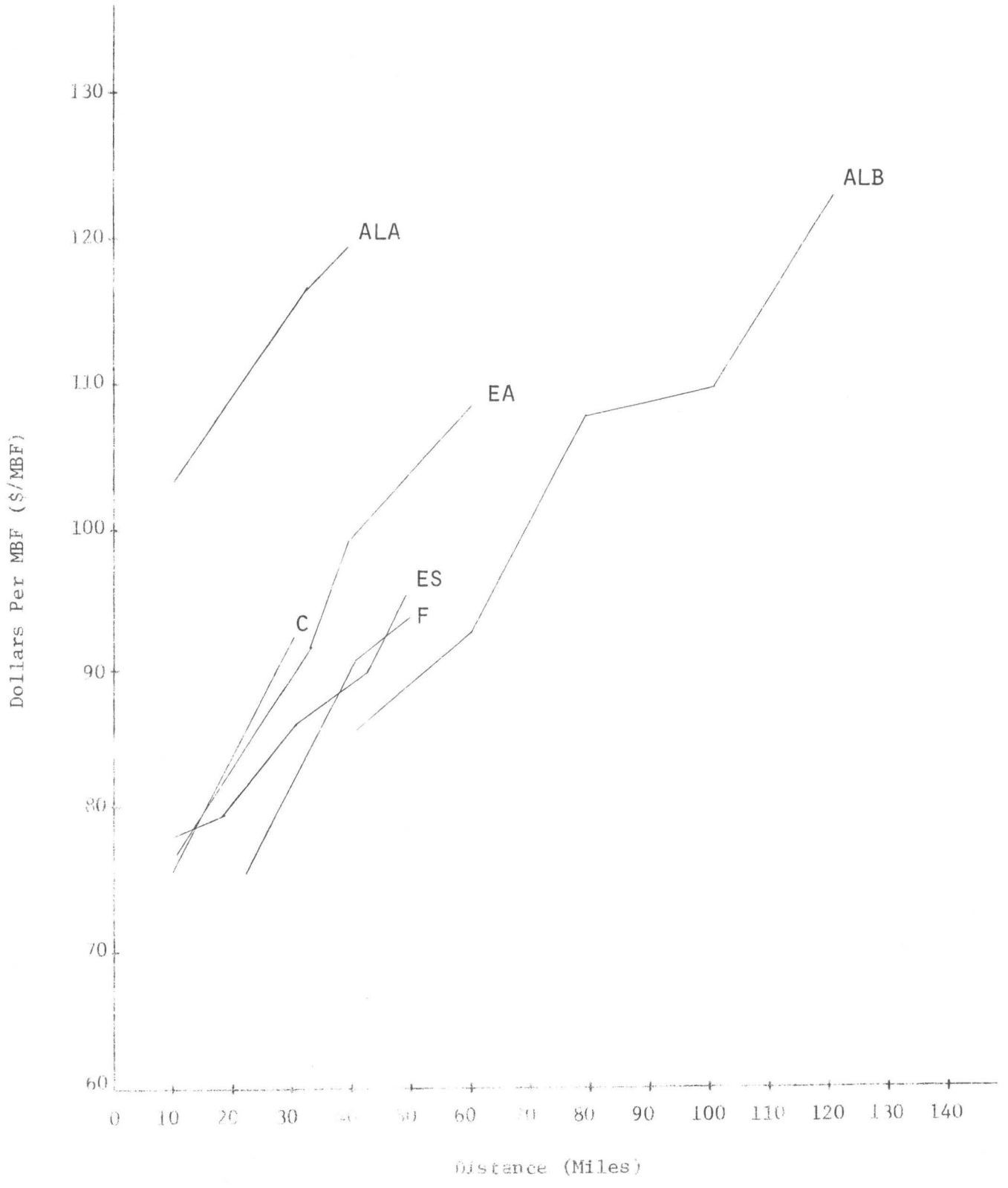
b. Timber Supply Economics

From a timber supply standpoint costs are more favorable in Arizona timbersheds. In part, this is related to the fact that the timber is larger and has less defect. Since appraisals use the residual value method stumpage rates in Arizona are generally higher.

Probably the best indicator of a favorable timber supply situation is the percentage cost make-up of lumber selling value. On the average, disregarding species, this is about 70 percent for the timbersheds in the two states. Alamogordo has the least favorable ratio, or percentage, at 82 percent. This is 10 percent more than the next highest percentage. Fredonia has the most favorable percentage of 64 percent. In general Arizona mills have a better situation regarding cost vs. selling value.

Comparing percentage of lumber selling value to costs between mixed conifer and ponderosa pine gave varying results. In general, the percentages are the same for both species but they are slightly higher for mixed conifer in Arizona (by about 5 percent) and slightly lower (by about 4 percent) in New Mexico. It seems that, compared to ponderosa pine, mixed conifer costs in relation to selling value are more favorable in New Mexico timbersheds. However, in both cases (ponderosa pine and mixed conifer) costs make up a larger proportion of selling value in New Mexico timbersheds. This gives some indication of where lumber price changes are likely to have the most impact on profitability.

In terms of distance to travel for timber, the Albuquerque processing center, by far, has to travel the longest distance (Figure VIII-1). Most of the other processing centers travel similar distances



F - Fredonia
ES - Espanola
C - Cuba

EA - Eagar
ALB - Albuquerque
ALA - Alamogordo

Figure VIII-1. Composite of Aggregate Volumes to Distance.

for timber but costs/mbf are generally higher for the Eagar and Alamogordo timbersheds. This is due to the characteristics of the timbershed regarding volume distribution, road type and distribution, and logging costs.

The total volumes available in the standard component within timbersheds is greater in the Arizona cases. Less volumes are available in the other timbersheds and the cost per mbf for additional volumes rises more rapidly in the New Mexico timbersheds (Figure VIII-2). For any given price (logs at the mill deck) much more volume can be procured from the Arizona timbersheds. Because of the amounts of this volume price changes will affect the cumulative volumes economically available much more in the Arizona timbersheds than in the New Mexico cases.

Mixed conifer volumes are available at the least expense in the Cuba and Eagar timbersheds and most expensive in the cases of Alamogordo and Albuquerque (Figure VIII-3). In the case of Albuquerque, this is related in part, to the distance involved in log hauling. In the case of Alamogordo it is more a function of the characteristics of the timber itself. The ponderosa pine supply schedules are similar except Fredonia and Eagar are reversed. Fredonia volumes are cheaper, in this case, than Eagar (Figure VIII-4). Fredonia has a significantly longer haul associated with the mixed conifer timber. Overall, given the timbershed situations, mixed conifers are not more expensive to procure compared to ponderosa pine. In fact, in some cases they are less expensive.

In terms of economic efficiency, given the configuration of the timbersheds, the Arizona timbersheds offer better possibilities for intensive management of ponderosa pine and mixed conifer. Cuba/Espanola and Alamogordo/Albuquerque offer lesser opportunities, in that order.

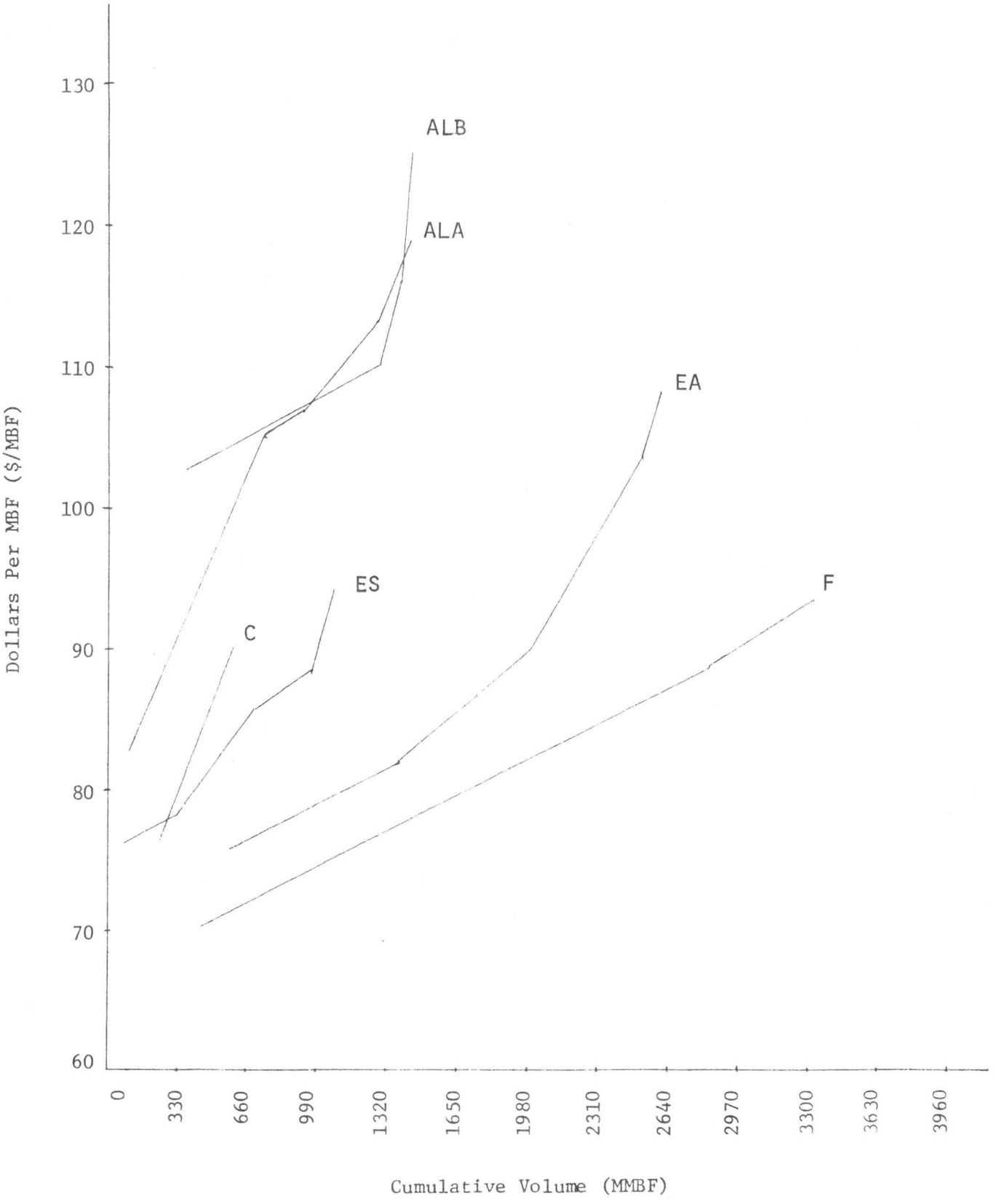


Figure VIII-2. Composite of Aggregate Volumes Available.

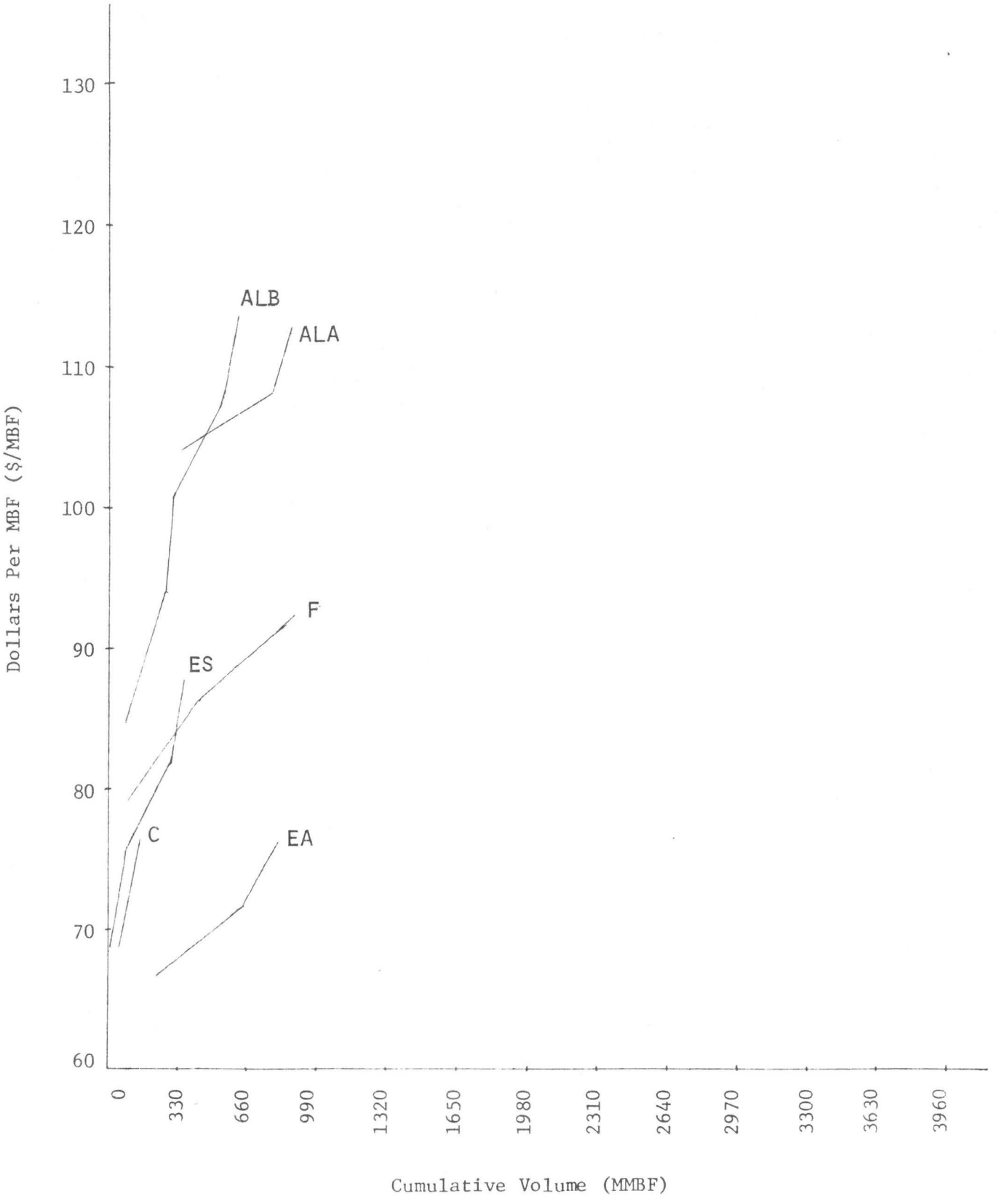


Figure VIII-3. Composite of Mixed Conifer Volumes Available.

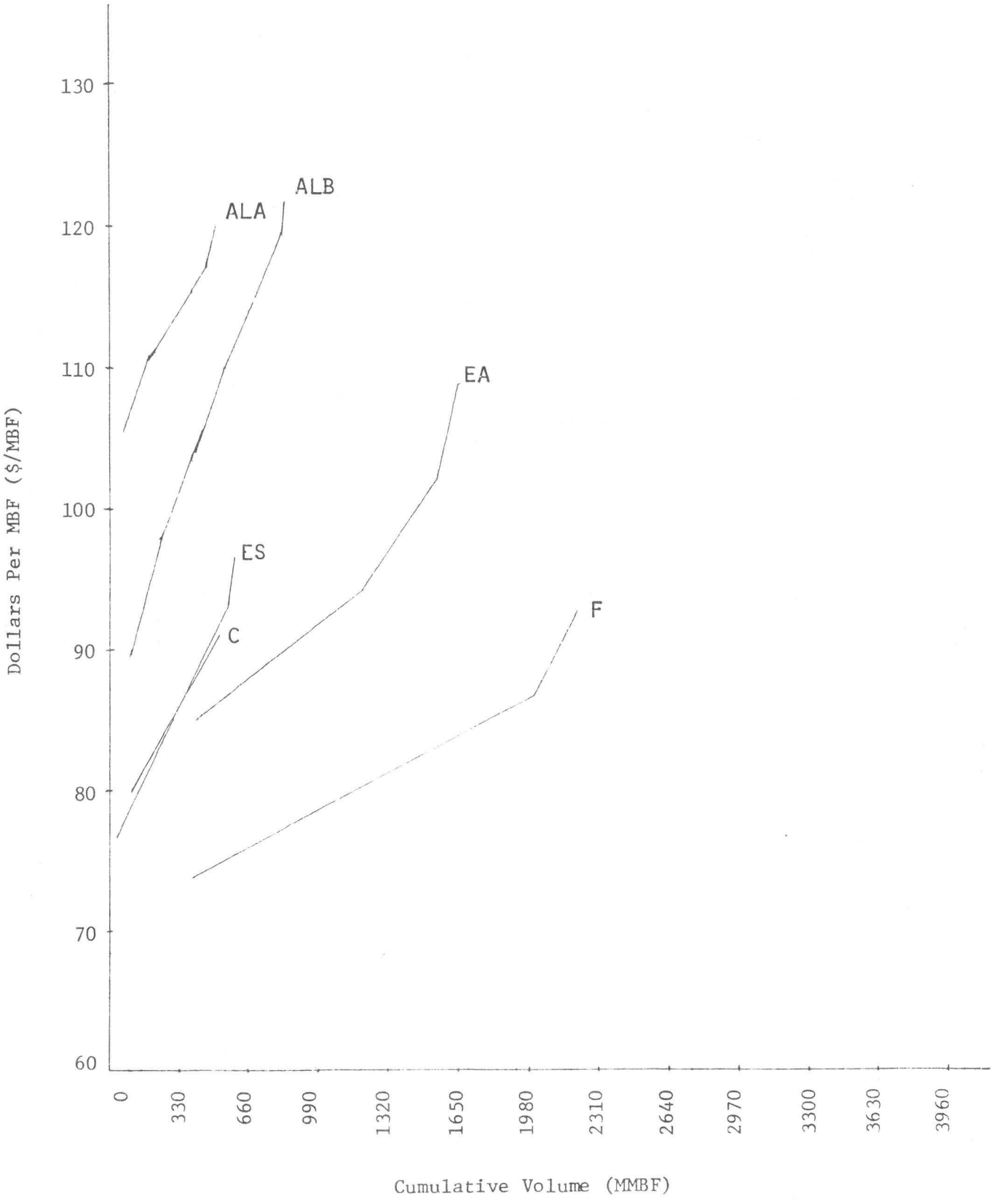


Figure VIII-4. Composite of Ponderosa Pine Volumes Available.

c. Mills, Products, and Markets

The processing center mills average about 20 to 35 mmbf per year lumber production. Five large companies dominate the production: Duke City, Southwest, Kaibab, White Sands, and Bates. The bulk of their production is either dimensional lumber or planed/rough boards. Some shop material is also produced. The Alamogordo mill produces studs. Generally, the mixed conifer raw material is used to produce dimension lumber for the framing market. Most of the lumber is either kiln dried or air dried. Some Douglas-fir is sold "surface green." The mills ship chips to the pulp mill in Snowflake, Arizona and shavings to the particleboard plant in Albuquerque. Sawdust is most often burned as waste or as a source of heat for boilers.

The mills (except Albuquerque) are located in fairly small towns. In these small towns the mills account for 20 to 40 percent of the employment. They are a major economic factor in the local economy. There is some competition for timber, particularly in northern New Mexico. On most National Forests there is a small business set-aside program to provide timber to operators that qualify.

Most of the mills deal with large volume orders of dimension and board material which rely on the housing construction market as an outlet. Several other product lines, not currently produced, could be produced in small quantities. These product lines would involve other market outlets, decreasing the mill's dependency on housing. Several of these products would utilize materials which are of marginal value for lumber. These products would include: posts and poles (now only one existing operation), house logs, barn poles, utility poles, viega poles, timbers, props, cribbing, rails, shakes, shingles, pallets, and lumber for

furniture stock (including waterbed frames). There appears to be a strong existing market for these products. Although there would not be the volume of production here as there is with construction lumber, there would be ample outlets for this material. The capital investment in these cases would be minimal, at least compared to other options such as flakeboard, particleboard, or pulp and paper. In total, these products seem to offer possibilities for increased utilization and, at the same time, intensive timber management.

The expanding use of wood for energy also offers some opportunity for the mills as well as the land manager. In all the timbersheds both free-use and commercial fuelwood operations have increased dramatically over the last few years. In most cases, fuelwood is now valued at $75 to $125 per cord. Mills may find an outlet for a certain amount of mill residue with commercial fuelwood dealers. Land managers can increase utilization and timber management by making slash available to free-use collectors and preparing timber stand improvement sales for commercial fuelwood operators.

Most mills ship to markets using only truck transportation and wholesaler distributors. Some use rail when shipping to Midwest markets. There is a strong, local "Sunbelt" market for lumber. Other major markets include the states of Illinois, Michigan, Minnesota, Wisconsin, Texas, Oklahoma, and California. The "Sunbelt" market should become increasingly lucrative as energy costs make transportation-to-market charges more expensive.

The most profitable markets now seem to be Chicago, Denver, Dallas, and El Paso, in that order. This considers both the comparative advantage dealing with freight costs and the local lumber price/demand. In general,

the New Mexico mills have more favorable transportation-to-market costs than Arizona mills (except for Los Angeles). Espanola and Cuba processing centers have the best situation overall. Alamogordo has the best rates to Texas markets. All processing centers are about the same in terms of rates to Denver.

In summary, the existing raw material and cost situation point to Arizona timbersheds as having economic advantages over New Mexico. There are no major differences in timber costs concerning ponderosa pine and mixed conifer procurement. Potential yield programs, if developed, would generate the most impact and expanded capacity in New Mexico timbersheds. Prescriptions in the region will generate smaller-sized, poorer quality material. Mills need to diversity product lines to utilize such material and at the same time decrease dependency on housing markets. The most favorable markets are within the Sunbelt states, Midwest, and Texas. New Mexico has freight advantages over Arizona.